RESPONSE TO CALL FOR PROPOSALS

FISHERY MANAGEMENT PLAN or REGULATORY AMENDMENT PROPOSAL
North Pacific Fishery Management Council – Steller Sea Lion Mitigation Committee
Provide the following information – attach additional pages as necessary:

Name of Proposer: **At-sea Processors Association** **Date:** **August 18, 2006**

Address: **4039 21st Avenue W., Suite 400**
Seattle, WA 98199

Telephone: **206-285-5139**

Fishery Management Plan: **BSAI Groundfish Management Plan**

Brief Statement of Proposal

Movement of the Pollock A season starting date from the current date of January 20 to a date 10-15 days earlier, e.g. January 5-10.

Objectives of Proposal

As discussed in the white paper prepared by Council staff member Bill Wilson in October of 2005 (see, Attachment A), pollock roe is one of the most valuable products produced in the BSAI Groundfish fisheries. The peak of prime roe production occurs in a relatively narrow window of time during the first three months of the year. Delaying start of the pollock A season until January 20, as the current regulations provide, presents the risk of the fleet missing some or all of the period of prime (highest quality) roe production. Loss of such production could cost the pollock industry, CDQ groups, fishing dependent communities and the State of Alaska tens of millions of dollars in lost revenues. Although the period of prime roe production is difficult to predict on a year to year basis, indications are that the trend has been towards an earlier onset of good roe production (e.g., roe maturity has been well-advanced at the opening of recent seasons). This indicates that an earlier start date would have enabled the fleet to better optimize roe production if it had the opportunity to start a week or two earlier in the year.

Relative to Steller sea lions, the current January 20 start date was evaluated in previous biological opinions and found necessary to provide protection during a period of the year considered critical for weaning juveniles. Recent biological evidence indicates that weaning takes place later in the year than originally thought (e.g., in April-June, rather than January to March as previously thought). See, Trites, et. al, Journal article in Aquatic Mammals, 2006, "Insights into the Timing of Weaning and the Attendance Patterns of Lactating Steller Sea Lions (Eumetopias jubaus) in Alaska During Winter, Spring, and Summer", p. 93 (Attachment B). In light of this new information, a shift in the A Season start date from January 20 to January 5th or 10th might even prove to be beneficial to Steller sea lions as it would shift the period of peak pollock fishing to a point earlier in the year and further away from the onset of weaning in late Spring.

Need and Justification for Council Action

The start date of the pollock A season is specified in the regulations governing the BSAI pollock fishery. A regulatory change is necessary to shift the official start date of January

20 to a date that occurs earlier in the year and Council action is necessary to initiate such a regulatory change. The economic rationale for such a shift was presented to the Council's SSC by Mr. Bill Wilson of the Council staff in December, 2005. In addition, the SSC considered the biological implications that such a shift would have for Steller Sea lions. The minutes from that meeting state, "Steller sea lion conservation has been raised as an issue with the proposal for an earlier opening of the eastern Bering Sea Pollock A season. The concern is that an earlier opening would be detrimental to sea lions. Based on knowledge of the timing of weaning and the reproductive energetics of adult females, the SSC feels that this is likely not a concern. Weaning normally occurs during late winter and spring. The energetic demands of adult females progressively increases throughout winter and spring as dependent offspring require increasing amounts of energy in the form of milk. Pregnant females require increasing amounts of energy (prey) with increasing fetus size throughout gestation. While a 5-day advance in the start of the A season is likely to be relatively insignificant to SSLs, the effect if any would likely be positive". (see, Attachment C).

<u>Foreseeable Impacts of Proposal</u>

There are no adverse impacts to other gear groups or fisheries that can not be easily addressed. For the Pollock industry, a shift to an earlier A season start date will provide industry flexibility for adjusting to variations in the timing of prime roe production. That flexibility might help the industry to avoid or at least minimize the economic consequences that would flow from missing some or all of the prime roe production period. Such consequences would be felt by all of the pollock sectors, the CDQ communities that participate in the pollock fishery, coastal communities such as Dutch Harbor that service the pollock fleet and the State of Alaska that derives tax revenues based in large part on the value of the BSAI pollock harvest.

<u>Possible Alternative Solutions</u>

There are no meaningful alternatives. Moving to an earlier A season start date, through consideration by the SSLMC and the Council, to be reflected in revised management measures under the new biological opinion, is the most prudent and comprehensive manner in which to proceed.

<u>Supporting Data & Other Information</u>

Council staff white paper on BSAI Pollock A season start date changes, October 2005 (Attachment A)

Trites, et. al, Journal article in Aquatic Mammals, 2006, "Insights into the Timing of Weaning and the Attendance Patterns of Lactating Steller Sea Lions (*Eumetopias jubatus*) in Alaska During Winter, Spring, and Summer." (Attachment B)

SSC minutes from December, 2005. (Attachment C)

<u>Off-setting Proposals</u>

No such offsetting measures are necessary. The proposed measure would actually be beneficial to Steller Sea Lions (see SSC minutes from Dec. 2005 meeting).

Signature: Kevin C. Duffy
Executive Director
At-sea Processors Association

Attachment A

AGENDA D-1(d)
OCTOBER 2005

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver
Executive Director

DATE: September 29, 2005

SUBJECT: Groundfish fishery management

ESTIMATED TIME
1 HOUR

ACTION REQUIRED

Receive discussion paper on BSAI pollock fishery "A" season start date and take action as appropriate.

BACKGROUND

At its June 2005 meeting, the Council received a request from industry to consider initiating analyses and possible future changes in regulations to allow the BSAI pollock fishery "A" season to begin 5 days earlier – on January 15 - instead of the current opening date of January 20. The "A" season primarily focuses on pollock roe, and industry testified that roe maturation seems to be occurring earlier in recent years. Industry suggested that starting the "A" season earlier would give more flexibility to the fleet in harvesting pollock with higher quality roe and thus market a more economically valuable product.

The Council requested that staff prepare a discussion paper that examines the various potential issues associated with starting the BSAI pollock "A" season fishery 5 days earlier, with a 5-day earlier closure of that season as well.

Attached as Item D-1(d)(1) is a discussion paper that examines some of the potential issues associated with an earlier "A" season pollock fishery in the BSAI. The paper addresses such issues as effects on other BSAI fisheries, effects on GOA sideboard fisheries, possible Steller sea lion issues, and effects on PSC bycatch. Council staff will present the discussion paper and answer questions.

AGENDA D-1(d)(1)
OCTOBER 2005

Issues Associated with Changing the Start Date of the Eastern Bering Sea Pollock Fishery "A" Season from January 20 to January 15

Prepared by:
Bill Wilson
North Pacific Fishery Management Council
October 2005

A. Introduction

The eastern Bering Sea pollock fishery accounts for a major proportion of the harvest tonnage in the BSAI region and a large amount of the ex-vessel revenues generated from the BSAI groundfish fisheries. Pollock roe is a valuable by-product from the EBS pollock fishery, nearly all of which comes from the "A" season. Current fishery regulations prohibit fishing for pollock before January 20. The eastern Bering Sea pollock fleet is concerned that a portion of the peak roe production is missed due to the January 20 start date, partly because roe-bearing pollock appear to be maturing earlier. An earlier start date, as little as five days, could enable the fleet to better maximize its production of high quality roe. Industry's interest is to start this fishery, on January 15, with an "A" season closure 5 days earlier as well (June 5). There would be no changes to the "B" season (June 10-November 1). The presumption is there could be a 5-day "stand down" between seasons as a result, although this issue needs to be addressed. This discussion paper outlines some of the issues associated with changing the opening date for the EBS pollock fishery "A" season as requested by the Council at its June 2005 meeting.[1]

B. Brief Overview of the Eastern Bering Sea Pollock Fishery

The EBS pollock fishery is the largest fishery managed by the Council, accounting for 65 percent of the nearly 2.3 million mt combined TAC for the BSAI and GOA groundfish fisheries for 2005. Prior to 1990, the EBS pollock fishery opened January 1 and the fishery was prosecuted in a single season. In 1990, the Council approved Amendment 14 to the BSAI FMP which prohibited pollock roe stripping and divided the EBS pollock fishery into a roe fishery ("A" season) and a non-roe fishery ("B" season). In 1992 under Amendment 19 to the BSAI FMP, the Council changed the starting date for some EBS trawl fisheries, including pollock, to January 20 (from January 1). In 1998, Steller sea lion protection measures were proposed and later implemented that established a 40/60

[1] Note that regulations at 50 CFR 679.23(c) prohibit trawling between January 1 and 20 in the BSAI and GOA; these regulations would have to be changed if the BSAI pollock "A" season start date is earlier than January 20.

percent split of the pollock TAC between the "A" and "B" seasons. Also in 1998 under the American Fisheries Act (AFA) the Council approved allocating 10 percent of the BSAI pollock quota to CDQ groups; after subtracting incidental catch allowance amounts for other fisheries, the remainder of the quota is apportioned 10 percent to catcher vessels delivering to motherships, 40 percent to catcher/processors processing offshore, and 50 percent to catcher vessels delivering inshore. Vessels harvesting pollock for their roe content are required to fully retain all fish under IR/IU requirements.

The AFA also provided for a system of pollock fishery cooperatives for each fishing sector, and prohibited the entry of new vessels into the fishery. The AFA also provided a system of harvesting and processing restrictions or "sideboards" on fishermen and processors who received the exclusive fishing rights under AFA to protect the interests of fishermen and processors who have not directly benefited from AFA.

In summary, under current regulations and provisions in the BSAI FMP, the EBS pollock fishery is entirely prosecuted by AFA fishing vessels – either through AFA-style harvesting cooperatives, or in connection with the CDQ program. The "A" season AFA pollock roe fishery is prosecuted by a fleet comprised of catcher vessels that deliver pollock to shoreside processors, catcher-processors, and catcher vessels delivering pollock to motherships. The fishery is entirely rationalized and vessels participate in this fishery under a cooperative management system. The "A" season begins January 20 and ends June 10. After reducing the annual TAC by 10 percent for the CDQ fisheries, and a certain amount for incidental catch allowances for other fisheries (3.35 % in 2005), the remaining directed fishing allowance (DFA) is divided so that 40 percent may be harvested in the "A" season and the remaining 60 percent in the "B" season. In 2005, the "A" season pollock roe fishery DFA (including CDQ) was 573,569 mt.

C. Origin of January 20 Start Date

Under Amendment 19 to the BSAI FMP (September 23, 1992), among several other management measures, the Council changed the opening date for certain trawl fisheries in the EBS from January 1 to January 20. The primary purpose for such a change was to reduce bycatch of halibut and salmon (especially Chinook salmon) as well as crab and herring in the EBS trawl fisheries. The amendment analysis also noted that the pollock fishery could benefit from a season delay "...that results in more of the harvest occurring later in the first quarter when the roe is at peak quality and value." For the years analyzed in the Amendment 19 EA, Chinook salmon bycatch rates were highest in the first few weeks of the year. The analysis also showed savings in halibut, crab, and other salmon bycatch with a later starting date in EBS trawl fisheries (excluding flatfish), but these results were more variable. Chinook bycatch seemed to be the primary motivation for moving the start date to January 20. Note that some concerns over halibut and crab bycatch were alleviated under Amendment 57 (June 2000) which prohibited the use of nonpelagic trawl gear in the directed pollock fishery.

Another consideration involved in changing the start dates to January 20 was the desire for both the BASI and the GOA trawl fisheries to start on the same date. If the GOA season opened earlier than the BSAI, the GOA fleet was concerned that the large-capacity BSAI trawl fleet could harvest a large proportion of the GOA quota and then move to the BSAI and continue to fish, potentially disadvantaging the GOA fleet. Such concerns may have been reduced to some extent by the subsequent implementation of the inshore/offshore amendments and AFA sideboard provisions which limit the ability of certain BSAI vessels to fish in the GOA.

D. Issues Associated with a January 15 EBS Pollock Fishery Start Date

Much of the following information was obtained from discussions with various sectors of the industry. Some of these issues may be tempered by certain future management regimes such as new rationalization programs, IR/IU amendments, etc.

The primary benefit of opening the EBS pollock fishery "A" season would be allowing the AFA fleet the opportunity to harvest roe-bearing pollock closer to the time the roe is of optimal quality. But some industry representatives believe that by implementing such a measure, other fishery sectors may be disadvantaged. Some of these concerns are outlined below. A shift in the "A" season dates also may have bycatch, protected resources, and other effects. The following provides a brief summary of these issues. Environmental and socioeconomic analyses would be required to determine the full nature and magnitude of these effects.

1. Increased Economic Return to the Pollock Fishery

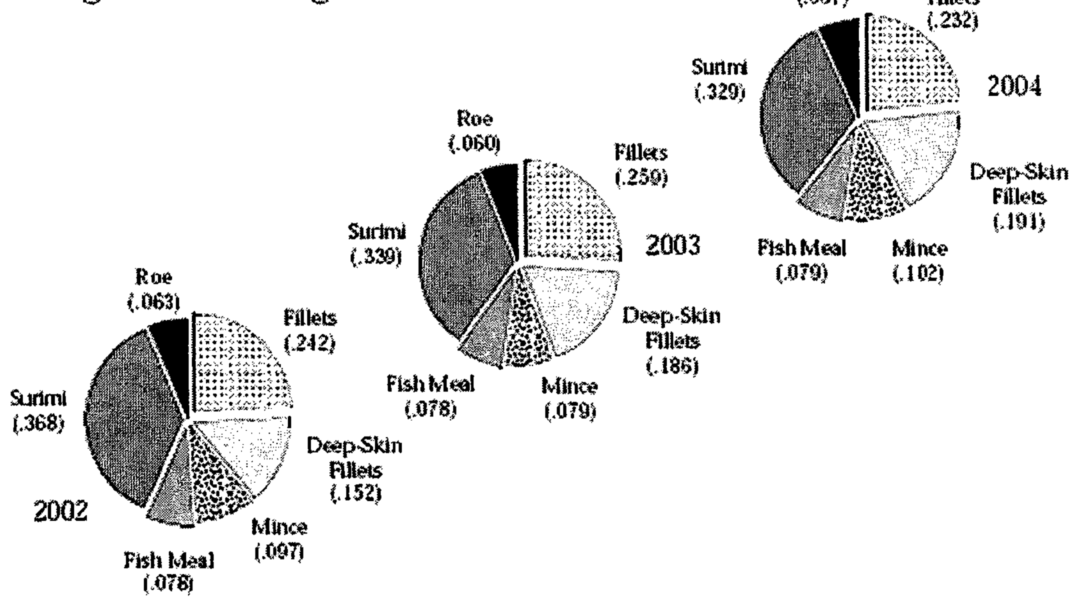
The Roe Fishery

Under BSAI FMP Amendment 11 (52 FR 45966, December 3, 1987) and later Amendment 14, the EBS pollock fishery was divided into an "A" season and a "B" season. The "A" season is primarily a fishery for roe-bearing female pollock. During the roe-bearing time of year, pollock group into spawning aggregations, and can be harvested with less fishing effort than later in the year; in the "A" season these fish are harvested primarily for roe which provides for a profitable market overseas, mainly in Japan. Roe is a term for female ovaries that are filled with maturing individual eggs held in sacs or skeins. Male testes ("milt") may be mature during the "A" season as well, and also are marketed, but roe provides the greatest economic return from the suite of pollock products from the "A" season. While the "A" season is focused on roe (and some milt), fillets and surimi are also produced. Approximately 14-15 % by weight of a headed/gutted mature gravid female pollock can be roe. Roe and milt combined range from 3.5 to 5 % of the catch by weight of fish in the round. These figures are averages, as the recovery of roe (and milt) can be highly variable as can the ratio of male to female fish taken during fishing operations. Larger horsepower vessels that can fish deeper waters may harvest pollock that can yield 5-6 % roe. Some roe is produced from pollock harvested in the "B" season as well, but recovery is significantly lower (generally around 0.5 % of round weight) during that time of year.

The average product mix from pollock in the Bering Sea is shown on Figures 1 and 2 based on data from the Pollock Conservation Cooperative. For the years 2002 through 2004, roe constituted 6 to 6.7 percent of products generated from the annual pollock harvest.

Figure 1. Pollock products marketed from Bering Sea fishery, 2002-2004 (Source: Figure 2 in Pollock Conservation Cooperative Annual Report for 2004)

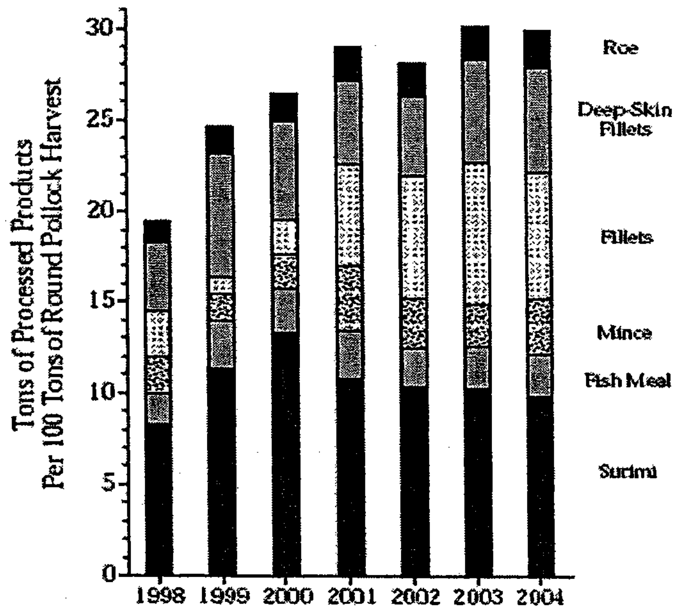
Figure 2. Average Product Mix.



Source: NMFS AK Region Pacific cod and pollock products by processing mode, 2002-2004. Note that this figure does not show individual product recovery rates, but instead the average product mix that was produced from the total amount of pollock harvested throughout the entire year. Pollock Conservation Cooperative vessels produce small amounts of pollock cheeks, milt, oil, stomachs and whole-round pollock that are not shown in the product mix pies.

Figure 2. Range of products and recovery rates from pollock harvested in the Bering Sea fishery, 1998-2004. (Source: Figure 3 in Pollock Conservation Cooperative Annual Report for 2004)

Figure 3. Total Product Recovery and Mix.



During 2001-2004 total product recovery is estimated to have increased by 50% over the 1998 open-access "race-for-fish" baseline.

Source: SeaState, Inc. PCC and CDQ catch per haul, 1998-2004; NMFS AK Region Pacific cod and pollock products by processing mode, 1998-2004, BSAI groundfish quotas and preliminary catch in round metric tons, 1999-2004, and CDQ participation and catch by gear, 1999-2004. Note that this figure does not show product recovery rates, but instead the average product mix produced from the total amount of pollock harvested throughout the entire year by all PCC member vessels.

Catcher vessels and catcher/processor vessels harvest pollock with pelagic trawls. Generally fishermen try to avoid filling the nets to capacity so as to minimize potential bruising and crushing of the fish – a practice which improves roe quality. Pollock delivered to processors onshore or to motherships or on board catcher/processor vessels are processed by automatic fillet machines, and viscera are hand sorted by specially trained crew members. Headed/gutted pollock continue through filleting machines and fillets are packed or further processed into surimi. Milt and roe are separated from the viscera, graded, packed, and frozen. Frozen lots are packaged and shipped to distribution centers to await auction. Samples from each lot are retained for examination by buyers during the auction process; auctions generally occur in February and April each year.

From 1992-1998, the pre-rationalization period that was characterized by the "race for fish", the duration of the EBS pollock "A" season gradually shortened from 46 days to 25 days for the offshore sector and from 46 days to 30-37 days for the inshore sector. After the AFA and new Steller sea lion protection measures came into place in the late 1990s, the "A" season lasted longer: 58-68 days for the mothership sector, 79-96 days for the catcher-processor sector, and 75-88 days for the inshore sector (2001-2003, excluding CDQ fisheries).

Roe Maturation

The industry's goal for the "A" season is to harvest as much of the seasonal pollock quota as possible, when roe is in optimum condition. Pollock roe is graded on multiple factors, including size, color, condition of the eggs (maturity), and damage. The optimal grade that would enjoy the highest value in the overseas market is generally a combination of these factors, with highest value from roe that are large mature skeins with no damage and good color. Combinations of these factors can lead to many possible roe grades, but industry has settled on approximately 16-17 grades. "Mako" grade is considered the premium, but buyers are the final determinant of quality, and thus price. Pollock fishermen and processors make pre-season and in-season decisions that attempt to optimize economic return.

In recent years, industry has encountered changing environmental conditions in the Bering Sea. Whether from climate regime shifts or other factors, industry has reported that Bering Sea waters seem to be warmer and more ice free in winter, and some suggest that warming trends may have affected the onset of pollock egg and sperm maturation. This effect has been noticed by the fleet in recent years as it has generally found more mature and higher quality roe-bearing pollock earlier in the season and in the cooler, more northern waters, particularly around the Pribilof Islands or even further north. The geographic location of fishing is not only determined by locations of highly concentrated pollock schools, but fishing also may be constrained geographically if salmon bycatch levels are reached that trigger closure of the Chinook Salmon Savings Area (CSSA), forcing the fleet to vacate the closed areas. The fleet also is constrained geographically by regulations restricting the amount of the "A" season TAC that can be harvested from the Steller Sea Lion Conservation Area (SCA).

In recent years, the quality of roe has become more unpredictable, and in some areas early in the "A" season, parts of the fleet have occasionally encountered spawned out schools while in other parts of the Bering Sea pollock schools harvested at the same time have yielded marketable roe. Given the geographic and temporal uncertainty in locations of optimal roe-bearing pollock, coupled with increased fuel and other costs to fish further from port, particularly for the shore-based fleet, the pollock industry believes that more harvesting efficiency, and therefore higher economic return, from the "A" season pollock quota could be achieved by allowing more flexibility in the start date of the "A" season. Given the small window of opportunity to harvest pollock during the period of peak roe maturity, an earlier start date for the "A" season would allow the industry the opportunity to capitalize on what appears to be a trend toward earlier maturity and enjoy greater economic return from the "A" season pollock quota.

Roe Value and Markets

The pollock fishery is unique and is affected by many factors. Each pollock fishing company develops its own fishing strategies as to where and when it will fish – decisions that remain proprietary to the individual fishing companies. As a consequence, each individual vessel, even those fishing for the same processor partner, will likely employ its own particular strategies to optimize return from the "A" season pollock fishery. For example, some roe buyers may prefer roe produced from a particular vessel because of its past performance, crew experience, or other factors, and thus that vessel and crew may seek to repeat past successful fishing strategies. Some indicate that given the changing conditions in the Bering Sea, the fleet has encountered more difficulty in repeating these strategies that may have worked well in past years. Some reports indicate that roe packed from the 2000 "A" season was much higher in quality than the roe packed from the 2004 season; for some companies 80% of the 2000 season was mako quality while 40% was marketed at that grade in 2004. According to the Southwest Regional Office, NMFS, the January-April 2004 average wholesale price for pollock roe marketed at several major central wholesale markets in Japan was 2,178 yen/kg. High quality roe can command significantly higher market value; some report that mako grade roe can command 2,400 yen per kilogram or higher, while the lowest grades wholesale at 400-500 yen per kilogram. The average price for pollock roe was 3,077 yen/kg in late 2000 (State of Alaska, Japan Office 2001).[2] Of course, exchange rates will affect roe value in overseas markets.[3] Industry reports that earlier season fishing routinely produces a higher percentage of prime quality roe, while late season fishing routinely produces a higher percentage of lower quality roe (and spawned-out fish).

Some vessels or fishing companies that have encountered a higher proportion of lower quality roe in recent years have sought to produce higher quantities of lower grades to compensate. The spectrum of factors including sea ice and temperature changes, geographic closures (CSSA and SCA), and highly variable roe maturity from school to school appear to have created a narrower window of prime roe production than existed in the 1990s. Industry believes that that window can be widened if the start date for the "A" season is moved to an earlier date than January 20.

According to industry, the economic value of the 2005 "A" season roe fishery was about $230 million. Roe is a significant proportion of the total economic return from the overall Alaskan pollock fishery (Figure 3). Some fishing companies report a threefold higher value of roe from the first 10 days of the season versus the last ten days based on a blend of shoreside and at-sea product values. Markets are primarily in Japan and Korea (Figure 4), although roe is also sold in Canada, China, and Europe. February and March are the largest export value months of the year for pollock roe (Figure 5). According to the U.S. Department of Agriculture Fishery Products Market News, U.S. pollock product exports totaled $519 million in 2004, increasing 19 percent from 2003 exports. The European Union, Japan and Korea accounted for over 95 percent of U.S. exports in 2004. Pollock exports through the first five months of 2005 are up eight percent over

[2] Biweekly Seafood Narrative Report Vol 3, No 2, January 26, 2001.
[3] Yen/dollar on September 26, 2005 was 112.17.

2004 exports through May. Pollock roe and fillets account for the majority of the exports with fillet exports increasing from $21 million in 2000 to over $212 million in 2004. The roe exports were valued at $287 million in 2004 (Fishery Products Market News).

Other countries have a pollock roe fishery, primarily Russia, and China and Japan also harvest pollock for roe. Russia's fishery is principally in the Sea of Okhotsk; Japan is their primary market. Some secondary processing of the Alaskan roe pack is conducted in China or South Korea.

Other Potential Benefits

A 5-day earlier "A" season could be an advantage to AFA vessels that may choose to enter other fisheries earlier than they would have without the 5-day early start to the "A" season. However, some in the EBS pollock industry have indicated a desire to avoid such a scenario, and the Council could institute a standdown requirement for the pollock fleet to eliminate such concerns.

There may be other advantages to the EBS pollock fleet including increased opportunity to better schedule product offloads or stagger offloads to optimize fishing time (e.g. less time spent waiting for freighter arrival).

There also may be a tax revenue advantage to the State of Alaska which taxes fish landed shoreside. A higher value roe pack could generate higher tax revenues.

Other sectors of the fishing industry that derive economic benefits from the BSAI pollock fishery could benefit from any higher revenues generated from a higher value "A" season fishery including crews, processing plants and associated businesses, coastal communities, etc.

Any Down Side for the Pollock Fleet?

Vessels participating in an earlier "A" season in the EBS would need to sail to the fishing grounds that much earlier. If that season opened January 15, some operations might need to mobilize early in January, potentially affecting crew holidays. This might be felt more acutely by larger AFA vessels, particularly motherships or larger catcher/processors with large crews. Fishery managers also would have to gear up earlier, and observers would be required to be deployed earlier in the year.

Figure 3. Primary market countries for pollock in recent years. (Source: Fishery Products Market News http://www.fas.usda.gov/ffpd/Fish-Circular/Market_News/market.html)

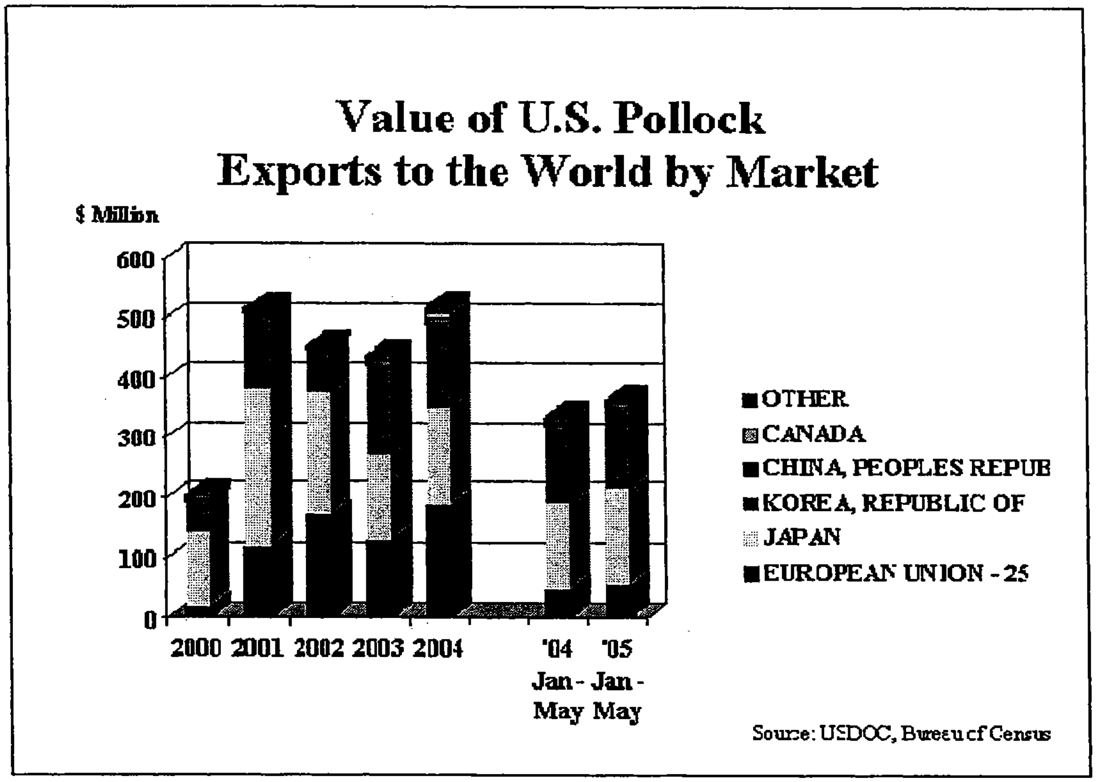


Figure 4. Value of pollock roe, fillets, and other products combined 2000-2004 and "A" season 2004 and 2005 compared. (Source: Fishery Products Market News http://www.fas.usda.gov/ffpd/Fish-Circular/Market_News/market.html)

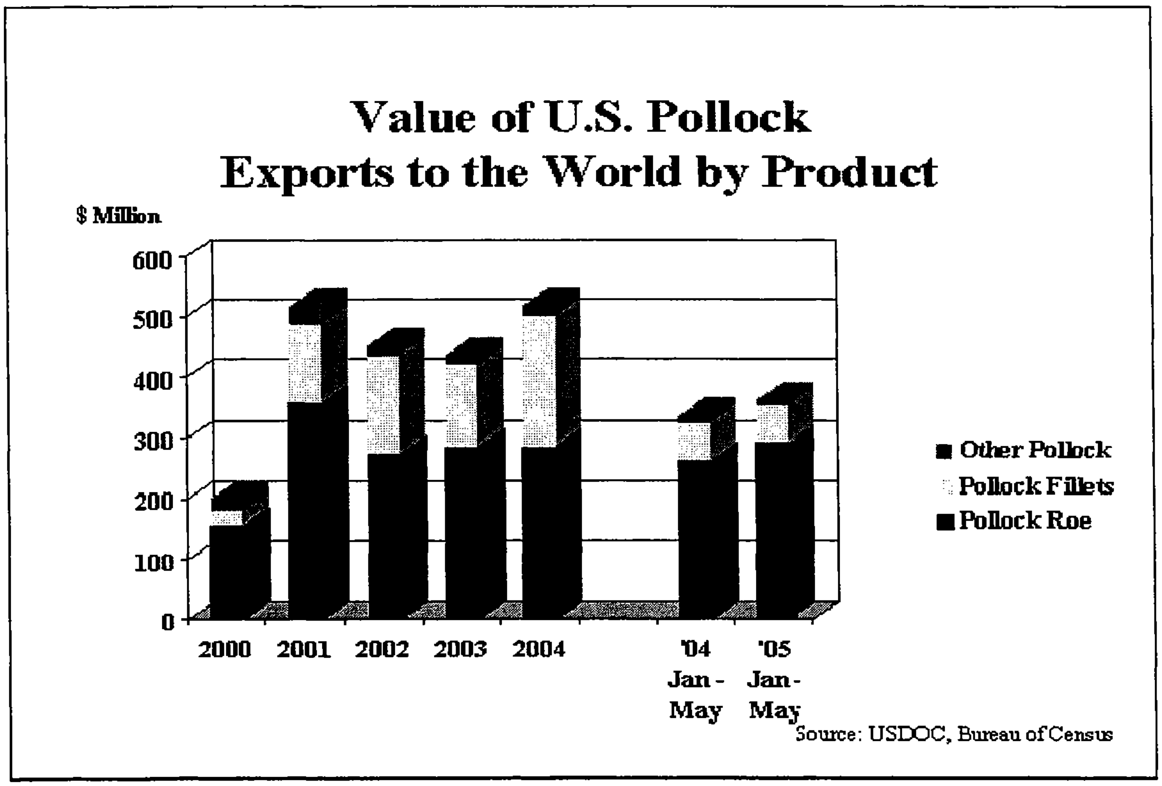
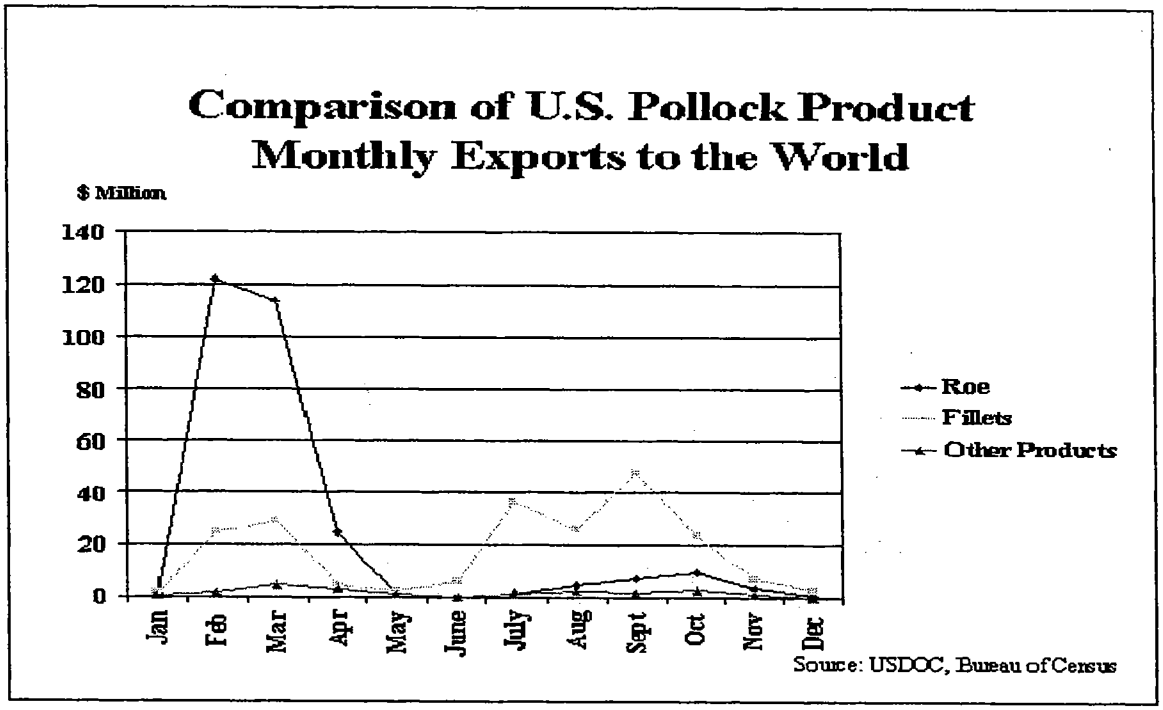


Figure 5. Monthly pollock export value by product type in 2004. (Source: Fishery Products Market News http://www.fas.usda.gov/ffpd/Fish-Circular/Market_News/market.html)



2. Impacts on Other BSAI Fisheries

<u>Would the Season Change be for the Pollock Fishery Only?</u>

An initial question for the Council to address is whether this 5-day earlier "A" season would be for the pollock fishery only or should it be applicable to other fisheries as well. Some industry sectors suggest that the Council should consider adjusting the start date for the "A" season for other groundfish trawl fisheries in the EBS so that they too commence with the pollock fishery.

<u>Impacts on Other Trawl Fisheries</u>

In effect, an earlier start of the pollock "A" season would provide an additional five days of fishing for the AFA fleet since the "A" season pollock quota is generally gone well before the regulatory end of the season. Some are concerned that providing an early start to the pollock season could result in listed AFA pollock catcher/processor vessels completing their harvest earlier, freeing these vessels to fish for other species such as yellowfin sole or P. cod earlier, or more intensively, than they would under the current season dates. Figure 6 illustrates locations of pollock harvesting activities during January 20-24 and Figure 7 shows P.cod and rock sole trawl locations during the same time period. Other sectors have expressed concern over the potential additional competition for harvesting. The AFA pollock fleet has a large harvesting and processing capacity which could disadvantage other fisheries in a race for a particular species. Although sideboards for these species are in place, these AFA vessels have not always reached those limits; some believe that an earlier start by listed AFA catcher/processors in a sideboard fishery could result in them harvesting a larger proportion of the sideboard limits, reducing the volume of fish available to other fleets and increasing competition. Fisheries with sideboards for listed AFA catcher/processor harvests include primarily Pacific cod, yellowfin sole, rockfish, and several other flatfish fisheries.

Figure 6. Locations of pollock trawl locations during the period January 20-24 for the years 2001, 2002, and 2004.

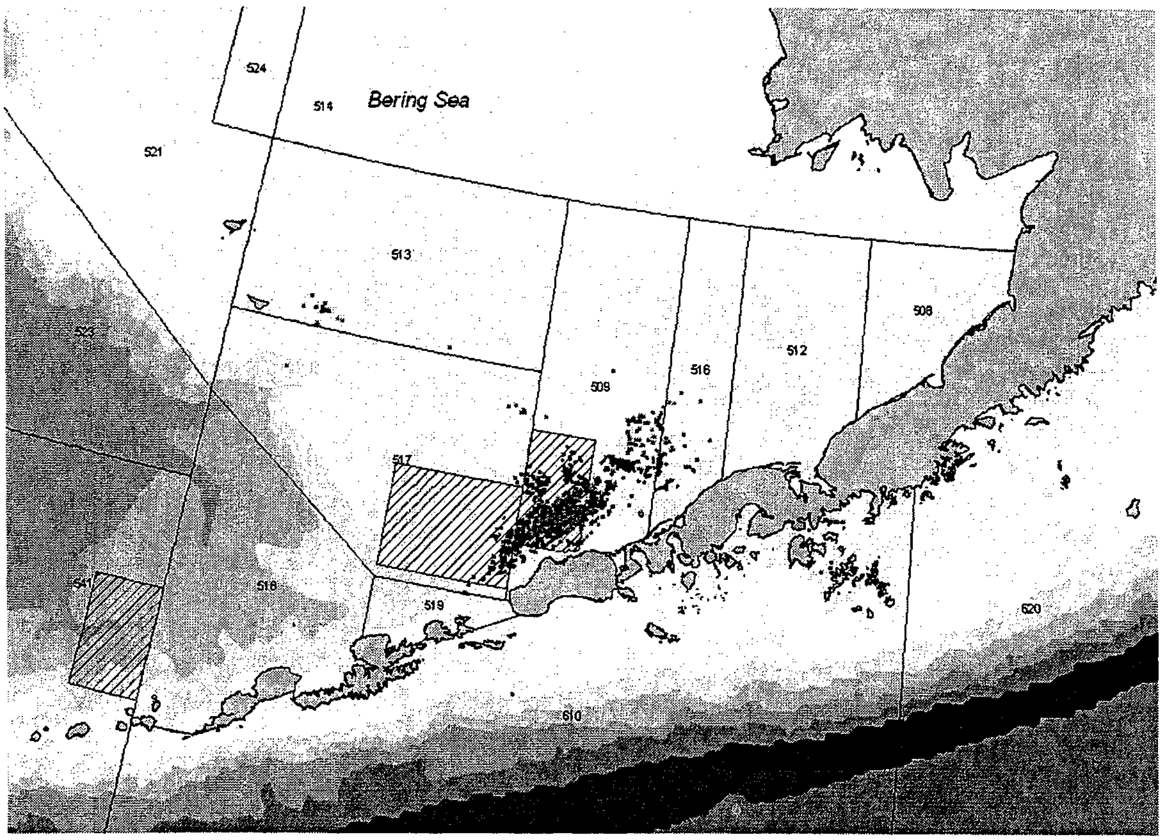
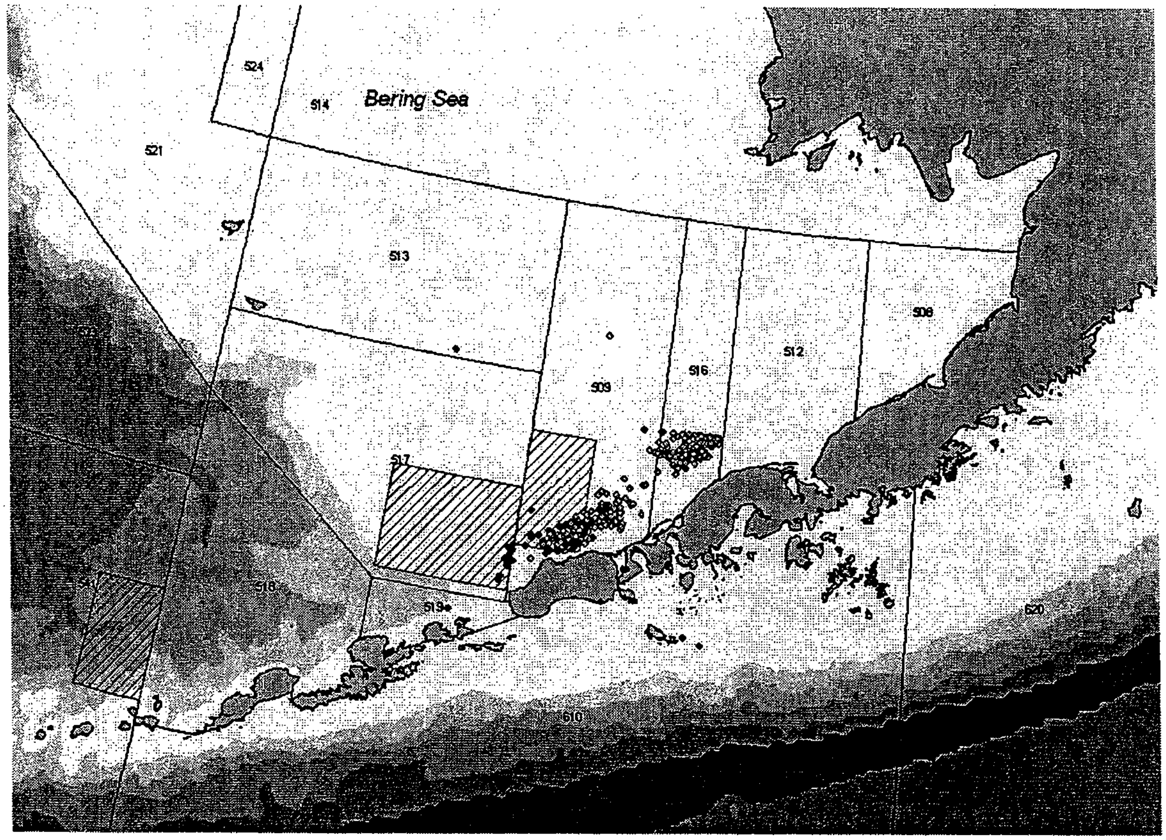


Figure 7. Locations of Pacific cod and rock sole trawl locations during the period January 20-24 for the years 2001, 2002, and 2004.



AFA catcher vessels are similarly restricted from harvesting other target groundfish stocks in the BSAI and have harvest sideboard limits for these fisheries. Similar effects from AFA catcher vessels on other fisheries could occur as described for listed AFA catcher/processors.

Some have raised a concern that in those years when pollock roe was not of optimal quality at the beginning of the "A" season, the AFA fleet (or portions of the fleet) could choose to delay fishing for pollock until roe maturity improved, and those vessels would instead focus on other groundfish. If the "A" season were set to begin even 5 days earlier, then under such a scenario other sectors might be further affected by the increased competition. Some in the pollock industry have suggested that this scenario could be eliminated by a provision limiting early "A" season AFA vessel fishing activity to pollock only.

Some industry representatives believe that, in practice, the BSAI currently experiences a race for P. cod among non-AFA vessels, AFA exempt vessels, and some AFA non-exempt vessels. Some assert that an earlier pollock "A" season would be a possible advantage to AFA non-exempt vessels, because they could complete the pollock fishery and then move that much earlier into P. cod, adding competitive pressure to those already participating.

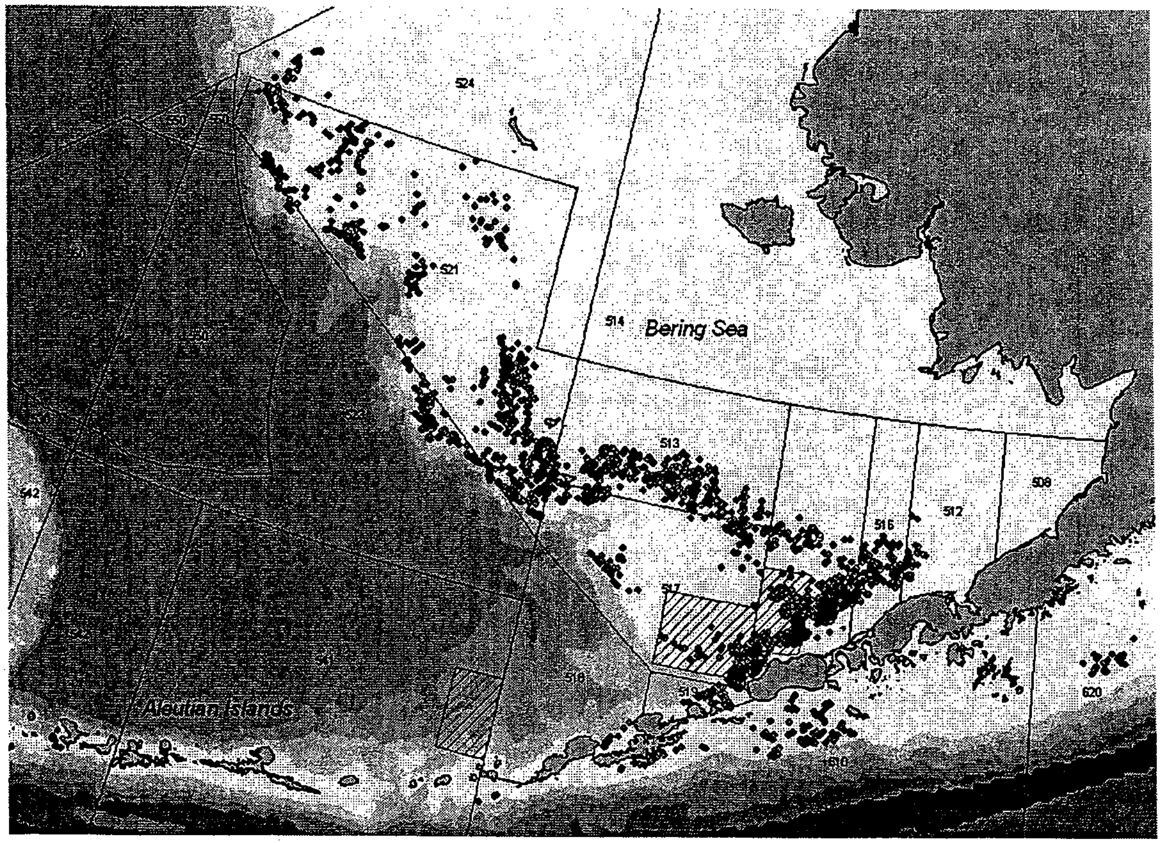
Options the Council could consider to reduce interactions between an AFA fleet fishing earlier in the "A" season and other BSAI fishermen might include a stand-down period or other measures to retain the current length of time listed AFA catcher/processor or catcher vessels can participate in other BSAI fisheries. Or some of these other non-AFA fisheries could be allowed to start 5 days earlier as well, either with or without restrictions on AFA vessel participation. Or the Council could restrict the AFA pollock fleet to a pollock-only fishery at the beginning of the EBS trawl season or for 5 days at the end.

But some believe that an early start for other trawl fisheries might have little or no compensating effect. For example, in mid January, some target species may not be aggregated or may not be mature, or markets may not be optimal, and thus providing an additional period of fishing for these sectors could have little or no benefit to them. Another scenario is that by providing an early start date for other trawl fisheries, this could result in their reaching their respective quotas more quickly. This could be considered a disadvantage if it lengthens the period these vessels must wait at the end of a particular fishery until the next fishery opens, causing vessels to stand down or return to port, thereby increasing cost.

Impacts on Fixed Gear Fisheries

Some assert that fixed gear fisheries could be affected to some extent by an earlier start date for the EBS pollock fishery. The longline fishing season opens in the Bering Sea on January 1, and the longline fleet has about 20 days of fishing time to prospect and locate optimal fishing grounds before trawl gear is deployed in the Bering Sea. Some in the fixed gear fishery sector believe they could be disadvantaged if that 20-day fishing period open only to fixed gear is shortened. The pollock trawl fleet might operate in some areas where fixed gear fisheries would operate, perhaps changing cod schooling behavior or preempting some areas of the fishing grounds and displacing fixed gear fisheries earlier than would occur under the status quo (Figure 8). Overlap of trawl and longline fisheries could be exacerbated in years when more geographically extensive ice conditions reduced the area of fishing grounds in the Bering Sea.

Figure 8. Locations of P. cod longline sets during January 1-20 for the years 2001, 2002, and 2004.



Impacts on Crab Fisheries

The EBS pollock "A" season occurs at the same time as the scheduled opilio and bairdi Tanner crab and brown king crab seasons, and may overlap spatially with these crab fisheries. While this overlap occurs currently, gear conflicts or grounds preemption issues have largely been avoided. It is unlikely that a 5-day earlier pollock "A" season would exacerbate this situation.

Now that a rationalization program is in place for the crab fisheries, it is unclear if there might be some kind of future effects of an earlier EBS "A" season on these crab fisheries. It may take some time for the crab fisheries to evolve and establish specific patterns of fishing activity in time and space before a clear answer might emerge. The complex interplay between weather, processor needs, markets, and other fisheries would require more research and analysis to better characterize how these issues might play out if there is a change in the EBS pollock "A" season.

3. Effects on Sideboard Fisheries in the GOA

If the EBS pollock fishery starts earlier, it is possible that the fishery could be completed earlier, allowing non-exempt and exempt AFA catcher vessels an earlier opportunity to move into the GOA and harvest groundfish there. To what extent earlier participation of these vessels in the GOA might affect the GOA-based fleet is unknown but could be similar to concerns listed above for other groundfish fishery sectors in the Bering Sea.

Under provisions of the AFA, non-exempt AFA catcher vessels have harvesting sideboard limitations in the GOA. AFA vessels that harvest pollock in the Bering Sea can fish in the GOA, but only up to specific quota limits. These limits protect GOA fishery sectors that have not benefited from provisions in the AFA from fishermen who have received exclusive harvesting privileges under the AFA. There is a segment of the AFA catcher vessel fleet that is exempt from harvesting sideboards – these are catcher vessels less than 125 ft LOA that have smaller harvesting privileges in the EBS pollock fishery and have significant historic participation in the GOA fisheries. There are approximately 16 exempt AFA catcher vessels.

Besides AFA catcher vessels being sideboarded based on harvesting history, there are additional restrictions that apply. Any catcher vessel fishing groundfish in the Bering Sea, when the Bering Sea is open to directed pollock fishing, cannot trawl in the WGOA or CGOA until three days after landing or offloading all groundfish. AFA catcher vessels are further restricted for pollock fishing in the GOA and are prohibited from fishing in the roe season or the non-roe season in both the EBS and the GOA during the same year. A vessel must choose between fishing in the EBS from January 20 to June 10 or fishing in the GOA from January 20 to May 31 for the roe season or fishing June 10 to November 1 in the EBS or August 25 to November 1 in the GOA for the non-roe season. Vessels less than 125 feet LOA are exempt from this restriction when fishing east of 157 degrees W (basically east of Sutwik Island at the eastern edge of the Shumagin Islands). Thus the pollock sideboard protection measures are more restrictive to AFA catcher vessels in the WGOA and part of the CGOA, and thus any possible effects of an earlier EBS pollock "A" season may be less in these areas. The above scenarios are largely theoretical. In practice, the GOA quotas for many fisheries for which AFA vessel sideboards exist close well before any AFA vessels could participate.

Given the above restrictions, and with a 5-day early start to the EBS pollock "A" season, an AFA cooperative could structure an intra-coop agreement that apportioned its pollock quota to all but, say, one of its member vessels, freeing that vessel to fish the GOA during the A/B season while the remaining coop vessels fished the coop's EBS quota – using the extra 5 days of fishing time to harvest what the excluded vessel would have fished. Such a situation could result in greater harvesting capacity introduced into the GOA.

4. Impacts on PSC or Other Species Bycatch

When the Council approved Amendment 19 to the BSAI FMP (1992), the Council had determined that BSAI trawl fisheries bycatch rates for halibut, salmon, crab, and herring often were higher early in the year, and decided to delay the start of the BSAI trawl fisheries to reduce those bycatch rates. While the Council recognized that bycatch rates were variable from year to year, the Council determined that delaying the start of trawl fisheries from January 1 to January 20 would benefit these PSC species, particularly Chinook salmon which showed the greatest potential benefit from a later season start date. Fixed gear fisheries were not considered a major concern and their start dates were left at January 1.

Today the Bering Sea pollock fishery is prosecuted under different conditions than were extant at the time Amendment 19 was implemented. The fishery in the early 1990s occurred before the American Fisheries Act and before the advent of pollock fishing cooperatives, and occurred under the Olympic system and its race for fish. Harvesting patterns and PSC bycatch rates and locations likely were different then than now. Also, Amendment 57 prohibited the use of nonpelagic trawl gear in the directed pollock fishery, thereby reducing concerns over bycatch of halibut and crab. In recent years, Chinook bycatch rates have been fairly level over the early part of the "A" season, occasionally spiking higher later in the "A" season (see Figure 9). It is probably reasonable to assume that the Chinook bycatch rate for the period January 15-20 would be similar to the recent January 20-25 rates.

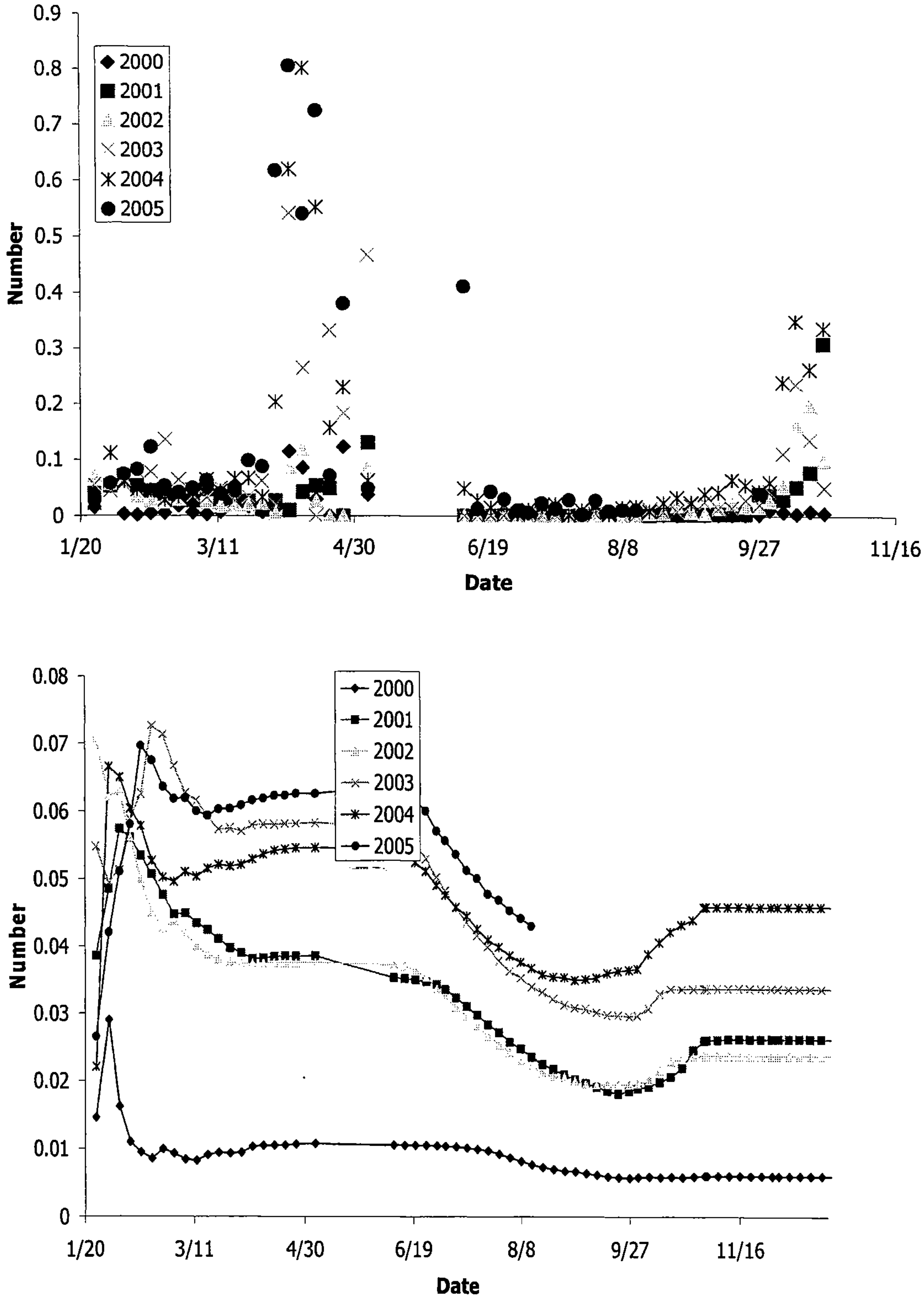


Figure 9. Chinook salmon catch rate (number per ton of pollock) based on observed vessels only (2000-2005). Top panel represents the average bycatch at 5-day intervals while the bottom panel represents the cumulative number per ton of pollock. Data for 2005 are preliminary and extend to Aug. 13, 2005.

A related issue is the potential for an earlier closure of the Chinook Salmon Savings Area (CSSA) in the Bering Sea. If a 5-day earlier fishery results in sufficiently-increased Chinook bycatch amounts such that the Chinook cap is hit prior to April 15, then the CSSA would close prior to April 15. In recent years that trigger has not been pulled but it was close in 2003-2005 (table below). Perhaps starting the pollock fishery earlier could provide an opportunity for increased Chinook bycatch such that the cap is reached before April 15, causing the fishery to be excluded from the CSSA during part of the "A" season. This could force the fleet into less desirable fishing areas, possibly into areas with higher PSC or other target species bycatch rates. If the Council chooses to start other trawl fisheries early as well, those fisheries also could encounter higher Chinook bycatch rates.

Year	Chinook non-CDQ Bycatch cap to Close CSSA	Non-CDQ Chinook Bycatch Jan 20-April 15
2001	37,925	16,679
2002	34,225	20,378
2003	30,525	32,103*
2004	26,825	22,822
2005	26,825	26,346

* CSSA not closed prior to Apr 15 in 2003; bycatch amount calculated later in year
Note: 2000-2001 data from blend; 2003-2005 from Catch Accounting System

Another factor to consider is that the cumulative annual Chinook and "other" salmon bycatch has increased in recent years; the reasons for these increases and potential measures to reduce bycatch are currently being examined by the Council. Under current salmon bycatch management in the EBS, the AFA cooperative fleet uses a voluntary hotspot salmon bycatch avoidance system, which would likely continue regardless what fishing season start dates were in place and perhaps maintain current rates. The Council is considering a change in how salmon bycatch is managed in the Bering Sea, possibly involving an expanded voluntary hot spot bycatch management program without salmon savings areas in place, and this future program also could affect salmon bycatch patterns. In turn, the analysis supporting the Council's preferred new alternative salmon bycatch program in the Bering Sea could be affected by a pollock fishery season change, and the new salmon bycatch program might be reevaluated accordingly. And the seasonal distribution of salmon may be different now because of changes in ocean conditions or salmon behavior, further affecting potential bycatch rates. Analysis of these factors and their various permutations would be required to better characterize the implications to salmon or other PSC bycatch from a change in the BSAI pollock fishery "A" season. An analysis of recent EBS pollock fishery salmon bycatch rates has been conducted by the Council; that analysis might be expanded to include alternative fishery start dates to examine potential effects on salmon bycatch.

Another possibility is that, with an earlier season start, and assuming pollock roe were in optimal quality and the harvest was more efficient and harvest amounts were higher early in the season, the pollock fleet might harvest its "A" season quota more quickly, shortening the season and potentially reducing PSC bycatch.

Industry is experimenting with alternative pollock trawl designs that include salmon excluder devices. If the industry sees a benefit from a salmon excluder in reducing salmon bycatch rates, it is likely that this new gear would affect salmon bycatch rates regardless what the season opening date was.

Listed AFA catcher/processors that harvest other target groundfish stocks in the BSAI area have PSC sideboard limits. PSC caught by listed AFA catcher/processors that participate in most BSAI groundfish fisheries other than pollock accrue PSC bycatch toward these PSC sideboard limits. Some of these listed AFA catcher/processors may fish earlier, or for a longer period of time, as a consequence of starting the EBS pollock "A" season earlier, perhaps encountering higher PSC bycatch rates. Harvest of sideboard quotas by these vessels could change if PSC limits are reached earlier. It is unclear that attaining sideboard PSC limits faster would affect other fisheries. Currently other groundfish fisheries experience seasons with low participation from AFA vessels, but if that changes to some degree, then the fishing opportunities they have also may change.

AFA catcher vessels are similarly restricted from harvesting other target groundfish stocks in the BSAI and have PSC sideboard limits for these fisheries. And non-exempt AFA catcher vessels that fish sideboard quotas in the GOA have PSC sideboard limitations. If these vessels fish earlier in the GOA, it is possible they may encounter different PSC bycatch rates that could affect how soon those PSC limits are reached. Again, it is unclear whether such scenarios could affect other fisheries.

As with salmon, other PSC bycatch rates could be different if the pollock fishery started earlier. Halibut, crab, other salmon, and herring bycatch rates would likely remain at similar rates during a fishery that occurred 5 days earlier, and higher bycatch amounts could accrue earlier in the season as a result. Bycatch of non-target groundfish also could change with a pollock season change.

If the Council extends the 5-day earlier season to other trawl fisheries, bycatch could change in each of those fisheries also. Or if the early season is not allowed in other trawl fisheries, but some level of grounds preemption or displacement occurs, other fisheries might incur different PSC or other target species bycatch rates in these other fishing areas. Analysis of historic bycatch rates in these fisheries could provide some insights into possible domino effects.

5. Effects on CDQ Fisheries

CDQ fisheries likely could be affected in ways similar to those discussed above. While these are individually smaller fisheries, CDQ groups may experience different effects on their fisheries performance depending on the nature of each group's fishing plans for a particular "A" season. For the most part, CDQ pollock fisheries are prosecuted by the same AFA vessels fishing the directed pollock quotas, so conflicts are unlikely. Some suggest that the CDQ fisheries could benefit from an enhanced economic return that could accrue to the overall pollock industry from a 5-day earlier start to the "A" season.

The CDQ pollock season in the BSAI is the same as the EBS pollock season, starting January 20. Would the Council consider changing the start date for the CDQ pollock fishery also if it chooses to begin the EBS pollock season earlier? And if other trawl fishery start dates are changed to match the EBS pollock fishery, would this apply to other CDQ fisheries? And to what extent might changes in CDQ fisheries affect the rates of PSQ bycatch in these fisheries? Currently CDQ fisheries are allocated 7.5 percent of the PSC for Chinook and other salmon and for halibut and the crab species.

6. Effects on Protected Species

Seabirds and marine mammals could be affected by an earlier pollock "A" season in the EBS. Additional fishing effort in the EBS could increase seabird injury or mortality, but probably at the rate currently experienced in this region in the mid- to late-January time period. An earlier closure of the season could reduce seabird and marine mammal interactions.

Similar interactions with marine mammals could be an issue of concern, particularly with Steller sea lions. In the 2001 Biological Opinion, NMFS determined that pollock is an important prey item for SSLs and established restrictions on the pollock fleet to buffer fishing activities from SSL prey in Critical Habitat. SSL researchers have determined that the winter season between November and April/May is a particularly sensitive time period for juvenile and lactating female sea lions that are foraging on pollock and other prey items. SSL protection measures provide for a closure of the GOA and BSAI to pollock fishing November 1-January 20. Starting the EBS pollock season earlier than January 20 would result in earlier removals of pollock from the EBS, possibly reducing the foraging opportunities for some SSLs. This issue could require a formal Section 7 consultation under the ESA to determine any possible concerns over jeopardizing SSLs or adversely modifying their critical habitat.

It is unclear how an earlier EBS pollock "A" season would affect the regulatory apportionment of the pollock DFA. Under Steller sea lion protection measures, only 40 percent of the quota can be harvested in the "A" season. And under regulations at 679.22(a)(7)(vii), the pollock harvest from the Steller sea lion conservation area (SCA) is limited to no more than 28 percent of the annual DFA before April 1. A 5-day longer pollock "A" season could speed the attainment of the 40 percent limit, or even the 28 percent limit in the SCA, although vessels in the SCA could simply move out to other fishing grounds. Historic patterns of fishing inside and outside the SCA, including PSC and other bycatch rates, would be required to better characterize this potential issue.

Also, endangered species of salmon and steelhead originating from streams in the Northwest U.S. may occur in the Bering Sea. In a 1999 Biological Opinion, NMFS determined that a Chinook bycatch limit of 55,000 would likely protect these ESUs from excessive bycatch mortality in groundfish fisheries in the BSAI region. The 1999 Incidental Take Statement (ITS) was superseded by the FMP 2000 BiOp and ITS which set a limit of 55,000 Chinook salmon in the BSAI groundfish fisheries. However, in

2004 this limit was exceeded, triggering a reinitiation of formal consultation between the NMFS Alaska Region and NMFS Northwest Region. At the current rate of Chinook salmon bycatch, the limit could be exceeded in 2005 as well, perhaps requiring another consultation depending on the actual level of bycatch. The bycatch of Chinook salmon was 40,866 as of September 17, 2005. An early start date for the pollock fishery could raise ESA issues with endangered or threatened salmonid ESUs if the bycatch of Chinook salmon were to increase as a result.

7. Effects on the Benthic Environment

Pollock harvest in the BSAI may only be conducted with pelagic trawls (regulations at 679.24(b)(4)) and operated within the trawl performance standard at 679.7(a)(14). This standard requires that no more than 20 crabs with a carapace width of >1.5 inches can be on board at any one time. Pelagic trawls can be fished near or on the seafloor, depending on where pollock targets occur or whether the seafloor is too rugged to risk fishing near bottom. While it may be unlikely that starting the "A" season earlier will result in more bottom contact, if pollock aggregations are found to be closer to the bottom earlier in the season, the potential increased bottom contact could affect benthic habitat.

Some Thoughts on the Current Fishery Management Balance

Based on the preceding discussion and the current state of the FMPs, one thing that is evident is the state of regulatory equilibrium. Some might characterize the status quo groundfish fisheries in the BSAI and GOA as being in a delicate but necessary "balance" among the many different and competing interests. Over a period of nearly 30 years under the Council process, gear groups have each established fishing patterns that "work" for them. The AFA has rationalized a large BSAI fishery and to some extent made fishing practices of the vessels involved in the AFA fishery more predictable. In all of the BSAI and GOA fisheries, PSC limits and apportionments have been developed through years of trials. Target species quotas and apportionments to sectors, seasons, CDQ groups, and as ICA for various fisheries have been established and many of the allocative decisions are largely suggested by industry itself. In short, the GOA and BSAI fisheries exist in a state of regulatory equilibrium.

Generally, change in a fishery, no matter how small it may be, may have consequences that alter this regulatory equilibrium. In rationalized fishery systems, every sector participating in those fisheries each has received a level of control over its own fishery. Change in a particular fishery sector, then, would be "felt" primarily in that sector and would be "worked out" within the sector in most cases. However, in a system not yet fully rationalized, where rationalized fisheries are prosecuted concurrently with fisheries that are still in a race for fish, even a change that may appear small and inconsequential in one sector, particularly a rationalized sector, can still have, or at least initially can be perceived to have, undesirable consequences to another sector. Thus, as is usually the case, a socio-economic review and analysis of the balance among these systems in the Bering Sea, as it might relate to a change in fishing seasons, would identify these issues.

Attachment B

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Insights into the Timing of Weaning and the Attendance Patterns of Lactating Steller Sea Lions (*Eumetopias jubatus*) in Alaska During Winter, Spring, and Summer

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Abstract

Behavioral observations of lactating Steller sea lions (*Eumetopias jubatus*) and their offspring were recorded at four haulout sites in Alaska to determine (1) whether sea lions wean during winter while they are 7 to 9 mo old and (2) whether sea lions using sites in the Gulf of Alaska (the declining endangered population) made longer foraging trips than sea lions in southeast Alaska (where the population appeared larger and healthier). Longer foraging trips are commonly thought to be an indicator of nutritional stress. Eight sets of behavioral observations were made using focal and scan-sampling techniques at haulouts from 1995 to 1998 during three seasons (winter, spring, and summer). Counter to expectations, we found no significant differences between haulout populations in the time that lactating Steller sea lions spent at sea or on shore. This suggests that lactating sea lions did not have more difficulty capturing prey from winter through summer in the area of decline compared to where sea lion numbers increased. Lactating Steller sea lions in both regions did make longer foraging trips in winter than they did in spring and summer. These changes in foraging patterns among seasons were consistent among all years and sites. The proportion of time that immature Steller sea lions suckled declined through the spring to early summer, suggesting that sea lions began supplementing their milk diet with solid food in the spring. We did not observe any sea lions weaning during winter; rather, most appeared to wean at the start of the breeding season when they were 1 or 2 y old. Sea lions observed in southeast Alaska during the late 1990s while population growth was slowing suggest that most males weaned at 2 y and that about 50% of females weaned at 1 y and the remainder at 2 y.

Key Words: Steller sea lion, *Eumetopias jubatus*, wean, forage, nutrition stress, Alaska

Introduction

Steller sea lions (*Eumetopias jubatus*) consist of two genetically distinct populations (Bickham et al., 1996). The eastern population (east of Cape St. Elias, Alaska) increased through the 1980s and 1990s, while the western population declined and was declared endangered in 1997 (Trites & Larkin, 1996; Loughlin, 1998; Figure 1). For much of the 1990s, the leading hypothesis for the decline of the western population of Steller sea lions was food stress, with the most dire consequence thought to be the starvation of immature animals following weaning (Calkins & Goodwin, 1988; Alaska Sea Grant, 1993; York, 1994; DeMaster & Atkinson, 2002; Trites & Donnelly, 2003). Proposed shortages of food (either reduced total consumption of all principal sea lion prey or reduced consumption of higher quality—high-energy—species) may have been caused by commercial fisheries and/or by natural changes in the ecosystem (Trites & Donnelly, 2003; Trites et al., 2006).

The primary objective of our study was to fill an important gap in our understanding of the life history of Steller sea lions—specifically, to determine when Steller sea lions wean and are most susceptible to prey shortages. Empirical evidence to date can only ascertain that the majority of Steller sea lions wean sometime before their first birthday (June) (Pitcher & Calkins, 1981), although some may nurse for 2 y or longer (Gentry, 1970; Sandegren, 1970; Perlov, 1980; Calkins & Pitcher, 1982). Weaning may occur during late gestation (April to May) (Pitcher et al., 1998) or it may occur much earlier (November to March) (Merrick, 1995; Merrick & Loughlin, 1997). The timing of weaning is uncertain and may hold the key to understanding the decline of the western sea lion population if the apparent absence of young animals (York, 1994) can be related to a critical time of year such as winter when young animals may have greater difficulty in finding food.

In addition to weaning behavior, we also sought to document seasonal patterns in attendance behaviors (time on shore nursing and time at sea feeding) of mature females with pups (0 to 12 mo) and yearlings (13 to 24 mo). We particularly wanted to know how foraging times changed over the course of a year and whether there was any indication of sea lions having greater difficulty procuring prey during the winter than during summer. We also wanted to test for differences in maternal attendance patterns between animals in the regions of population increase and population decline of Alaska. If the decline of Steller sea lions was related to a shortage of prey, the *a priori* expectation was that animals in this region would make longer feeding trips and would spend less time with their young than those in stable populations (Costa et al., 1989; Trillmich & Ono, 1991; Boyd et al., 1994; Boyd, 1999; Campagna et al., 2001; Soto et al., 2006).

Behavioral research provides a means for determining the timing of weaning and assessing the nutritional status of Steller sea lions. To date, most behavioral studies of Steller sea lions have concentrated on summer breeding areas (rookeries) (see Gentry, 1970; Sandegren, 1970; Gisiner, 1985; Milette & Trites, 2003) and have overlooked the nonbreeding sites (haulouts); yet, roughly 45% of the Steller sea lion population use haulouts during the summer rather than return to the rookeries (Trites & Larkin, 1996). Thus, we documented the attendance patterns and suckling behaviors of sea lions using haulouts comprised of juveniles, nonbreeding immature animals, and mature females with and without dependent young.

Materials and Methods

Study Areas

Eight sets of behavioral observations were made over 4 y (1995 to 1998) from a total of four different haulout sites (Table 1). Winter observations were made at Cape St. Elias (1995) and Marmot Island (1996, 1997) in the Gulf of Alaska (declining populations), and at Timbered Island (1996) in southeastern Alaska (a stable or increasing population; Figure 1). Spring observations were made at only one site (Timbered Island in 1998), while summer observations were made at Timbered Island (1996, 1997) and Sea Otter Island (1997, declining population). Our most consistently observed site was Timbered Island (winter 1996 to spring 1998).

Observations were performed from blinds with clear, unobstructed views of each haulout. All four sites were selected as typical Steller sea lion winter haulouts based on historical accounts and annual aerial count data, which indicated that high numbers of mature and immature animals were present during previous years (Alaska Department of Fish and Game [ADF&G] unpubl. census data). The sites were also selected for their ease of observation as well as for observer safety and logistical considerations.

Data Collection

Time spent ashore and at sea by pups, yearlings, and mature females with dependants was determined by the presence or absence of recognizable individuals at the haulout during daily observations. Many mature females observed at haulout sites in the Gulf of Alaska could be readily identified from distinct natural fungal patches; however, females from the increasing population (at Timbered Island) had fewer natural markings, making it difficult

Table 1. Dates and locations of behavioral observations of Steller sea lions on haulout sites in southeast Alaska and the Gulf of Alaska; total number of days and hours of observation are noted, as well as the number of individual mature females and immature sea lions (pups and yearlings) that were recognized by brands (branded) or natural markings (focal). Mature females were recognized by natural markings.

			Observation period		Immature		Mature	Total	Total
Location	Year	Season	Start	End	Branded	Focal	females	days	hours
Cape St. Elias	1995	Winter	28 Jan.	23 March	0	13	5	54	339
Marmot Island	1996	Winter	19 Jan.	15 Feb.	0	10	9	27	78
	1997	Winter	23 Jan.	14 March	3	29	26	50	285
Timbered Island	1996	Winter	22 Jan.	31 March	38	8	10	69	353
	1998	Spring	6 April	6 June	24	29	34	61	596
	1996	Summer	15 June	6 Aug.	37	7	7	52	602
	1997	Summer	20 May	7 Aug.	36	11	20	79	875
Sea Otter Island	1997	Summer	21 May	6 Aug.	0	19	18	77	747
All Sites					138	126	129	469	3,875

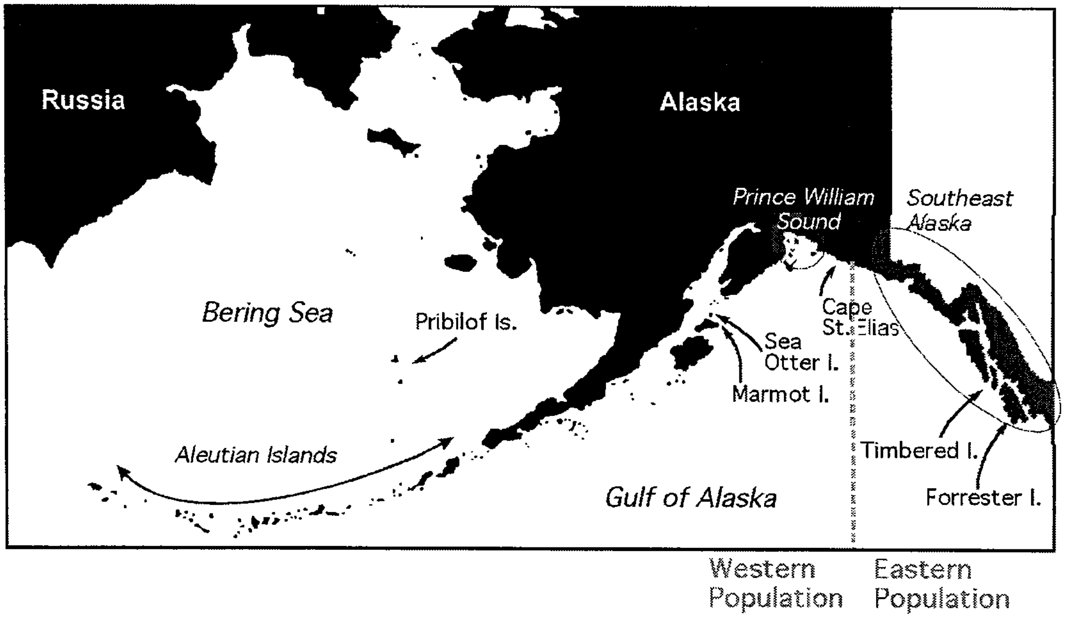

Figure 1. Locations of the four Steller sea lion behavioral study sites; Forrester Island, shown for reference, is where many of the immature sea lions we observed were branded as pups in 1994 and 1995.

to reliably identify individuals. Instead, we only counted them as present when seen with recognizable dependent offspring. A number of the pups and yearlings present at this site were previously branded in 1994 and 1995 (with a letter and three digits) by the ADF&G (1996) on Forrester Island (one of three major breeding sites in southeast Alaska; Figure 1, Table 1) when they were 1 mo old. Mature females were scored as away if they were not observed on the haulout with their dependent pup or yearling during daily observations.

The behavior and association of mothers and immature sea lions (pups and yearlings) were noted every 15 min using focal sampling (Martin & Bateson, 1993). Behavioral observations were restricted to daylight hours (maximum 0600-1900 h; average 0800-1630 h) and included more than 3,800 h of observations over 469 d (Table 1).

Data Analysis

Data from all sites and years were analyzed in the same manner to compare sites and seasons. Steller sea lions present at both dusk and dawn were assumed to have spent the night on the haulout. Similarly, animals absent at dusk and the following dawn were assumed to have been away all night. We also assumed that dry animals noted within the first 3 h of daily observations had spent the night on the haulout. When focal animals were first seen at the start of observations in the morning (but not the previous dusk), or last seen at the end of the day (but not the following morning), the midpoint during the night (between the end and start of observations) was calculated as the departure or arrival time. It was not possible to exclude the chance that individuals were hauled out at other sites, although previous work done with satellite telemetry showed adult females rarely haul out on multiple sites during foraging trips (ADF&G unpubl. data; Merrick & Loughlin, 1997). It was nevertheless possible for adult females to return to their haulouts and not reunite immediately with their pups and yearlings.

We defined trips (time spent away from the haulout) to be > 2.5 h and < 200 h as per Trites & Porter (2002). Short absences (≤ 2.5 h) often consisted of animals rafting or swimming nearshore for short periods (Trites, pers. obs.). This is consistent with summer studies at other sites in Alaska that used VHF telemetry and noted gaps in the frequency distributions of the signal record that were indicative of nonforaging activity (Brandon, 2000). Higgins et al. (1988) studied Steller sea lions in California and found no foraging trips lasting < 8 h. We examined the distribution of recorded trips and assumed those animals with trips > 200 h made an unrecorded visit to the haulout or had moved to another site for an extended period. We also assumed that those with absences ≤ 2.5 h were obscured for a short period and incorrectly noted as "absent" when they were actually present on land or in the water adjacent to the haulout. Hence, only absences > 2.5 h and < 200 h were included in our analyses. Average trip duration was calculated for each mother, pup, and yearling such that each animal contributed only a single value (their mean) to the appropriate grand mean estimate of trip duration (for all females or all immature animals combined).

Lengths of feeding trips from different field seasons were compared with both parametric (ANOVA) and nonparametric models (median test and Kruskal-Wallis test; Zar, 1996). Median lengths of feeding trips were broken down by week for the most extensive data sets (Timbered Island) and examined for directional changes over the field seasons.

Site fidelity was examined by calculating the percent of observation time that immature sea lions and their mothers were seen at a particular haulout. Percent of time present equaled the total number of hours that focal animals were on any given haulout divided by the total number of hours observers spent at any given site in any given season. We determined the percent of time young animals were with their mothers by dividing total time mothers were present by the number of hours we observed their young on the haulouts. This implicitly assumes that mothers were not on the haulout without their offspring. Percentages were arcsine-transformed for statistical analysis. An ANOVA model was used to test for geographic and seasonal differences in site fidelity of mothers and immature sea lions, as well as to test for differences in maternal attendance.

The proportion of time that young sea lions suckled was calculated as (1) a function of the total time they were on shore and (2) a function of the total time that their mothers were present. Percentages were arcsine-transformed and analyzed separately for yearlings and pups. To exclude weaned juveniles, only animals observed suckling at least once were included in the analysis. ANOVA was applied to the mean percentages, and Tukey tests were conducted to determine when and where suckling times differed significantly (Zar, 1996).

The proportion of the observed immature animals in the population that were observed to still be suckling during a particular week was also calculated in two ways. The first method calculated the proportion of branded immature sea lions (known to be < 24 mo) seen suckling during each week of observation. Only animals observed at least ten times per week were included in this analysis to ensure that we did not misclassify an animal as weaned due to insufficient observations. In general, a dependent offspring should suckle for about 10% of the time it is present (see "Results") and would likely be classified as weaned if rarely observed. Our second method to determine the timing of weaning used data from immature animals of unknown ages (i.e., focal animals that were not branded). Of this group, we assumed that animals were not fully weaned if they were seen suckling at least once each day.

Results

Suckling and Weaning

During winter, pups suckled for an average of 26% of the time they were on shore; however the percent of time varied from an average of 15% at Timbered Island (n = 23 focal animals) to 34% at Cape St. Elias (n = 5), and 20 and 36% at Marmot Island (n = 8 and 3). Standardizing suckling behavior—by calculating it as a portion of the time that mothers were present—showed that pups spent an average of 44% of their time with their mothers actively suckling (Table 2). There were no significant differences among the winter and spring sites ($F_{4,39} = 0.53$, $p = 0.72$). Thus, although there was considerable variability in the time that pups spent on shore in each area and between years waiting for their mothers to return, the pups appeared to spend a relatively uniform proportion of the time they had with their mothers engaged in suckling during the winter.

During the spring, pups at Timbered Island suckled an average of 45% of the time they were with their mothers (n = 5 pups), which corresponded to 44% of the time they were observed on shore; during winter, however, pups at Timbered Island suckled an average of 41% of the time they were with their mothers (n = 23 pups), which corresponded to 15% of the time they were observed on shore. Comparing these two sets of numbers suggests that the attendance patterns of mothers and pups were more synchronized during spring than during winter.

Table 2. Percent of time that branded Steller sea lion pups (n = 44) and yearlings (n = 70) were observed suckling with their mothers

	Pups suckling			Yearlings suckling				
Season	% time	SE	n	% time	SE	n	Age class comparison	
Winter	44.2	3.79	39	43.6	3.20	38	$t_{75} = 0.12$	$p = 0.90$
Spring	44.6	14.73	5	27.6	3.49	13	$t_{16} = 1.64$	$p = 0.12$
Summer	--	--	--	17.7	2.30	19	--	--

Yearlings (observed between the ages of 1.5 to 2.0 y old) suckled an average of 44% of the time they were with their mothers during winter (average of three sites: St. Elias, 1995; Timbered, 1996; Marmot, 1996 and 1997). Time spent suckling dropped significantly to 28% in spring (Timbered, 1998) and to 18% in summer (Timbered, 1996 and 1997; and Sea Otter, 1997) ($F_{7,62} = 5.23$, $p < 0.001$; Table 2).

An average of 87.6% of the branded pups observed at Timbered Island suckled through the winter months (at 31-41 w of age, based on a mean birth date at Forrester Island of 4 June; Pitcher et al., 2001a). Resuming observations

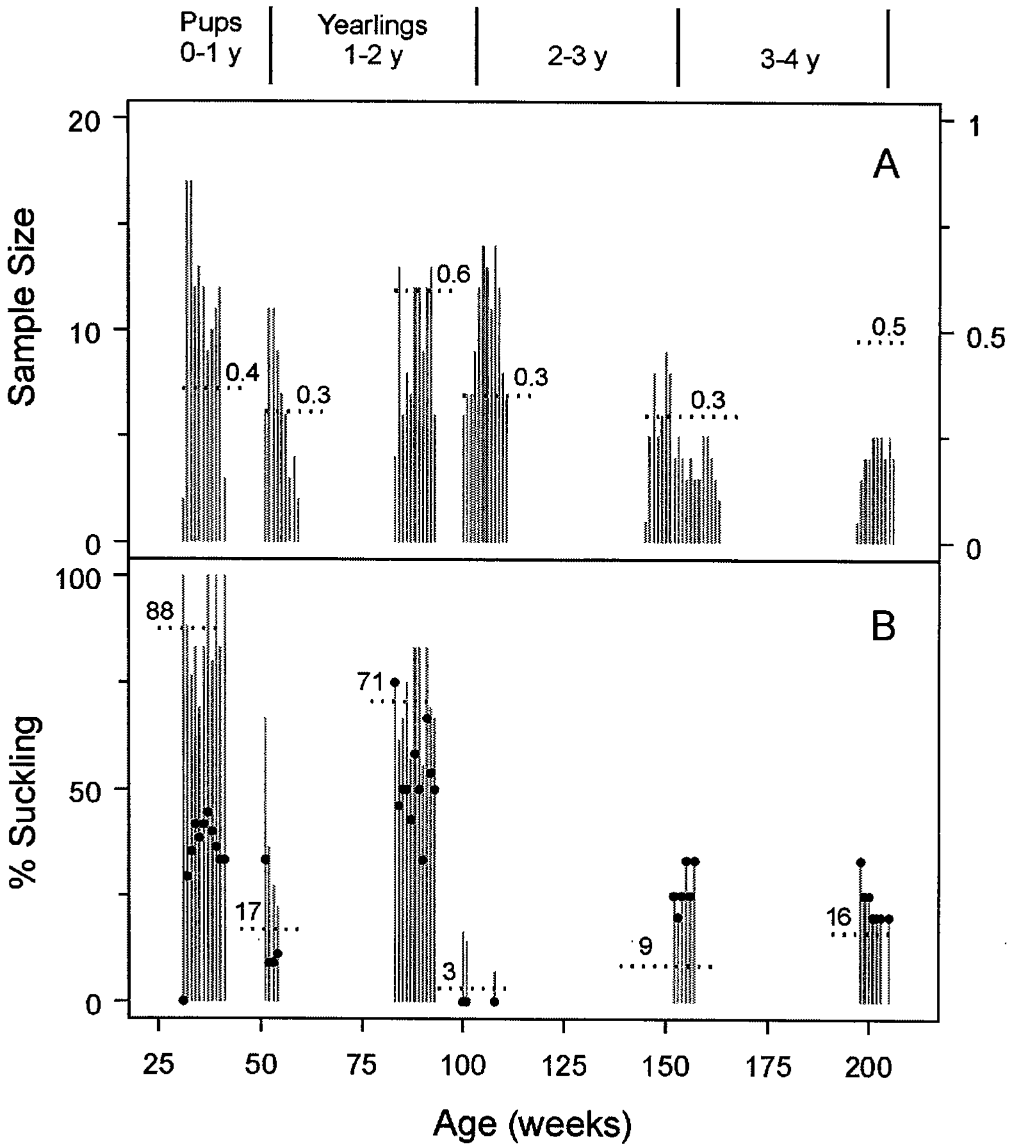

Figure 2. A. Number of branded Steller sea lions hauled out at Timbered Island by age in weeks and B. percent of branded pups and juveniles observed suckling by age in weeks. Sea lions were only observed during the periods denoted by the vertical bars in A. The dotted horizontal lines in A (right y-axis) indicate the proportion of branded pups and juveniles present on the haulout that were males. The dotted horizontal lines in B denote the mean percent of branded sea lion pups observed suckling during each study interval. Data points indicate the percentage of marked male pups observed suckling. Note that the individuals were branded in 1994 and 1995 at Forrester Island and have an assumed birth date of 4 June. Also note that the estimated percentage of sea lion pups continuing to suckle at age 3 and 4 y was the result of a repeated observation of a single male pup (brand no. F490).

during summer showed a significant drop in the percentage suckling at ages 51 to 54 w (Figure 2B). Most of the branded pups that remained at our study sites were females, and none were observed suckling through the remainder of the summer (ages 55 to 59 w). We also observed an average of 70.6% of the branded yearlings suckling at Timbered Island during the winter months (at 83 to 93 w of age), but only 15% during the first 2 w of summer observations (Figure 2B).

The ratio of male to female pups observed suckling was approximately equal from January to June; however, significantly more males than females were observed suckling a year later at 1.5 to 2 y of age (Figure 2B). A shift was also observed in the proportion of male pups observed at Timbered Island, which fell from 46% in January to 29% in June, and rose to 56% by the following January (Table 3). These data suggest that a greater proportion of female pups weaned in their first year, while a greater proportion of males stayed with their mothers for a second year.

We were able to determine the exact date of weaning for three focal animals. These three weaned on 2 June 1997 and 1 July 1999 at Timbered Island (both females, brand nos. F781 and F674, respectively) and on 20 June 1997 at Sea Otter Island (animal identified by natural markings, but sex unknown). These individuals suckled consistently until these dates and were not seen with their mothers thereafter. Thus, they were between the ages of 1 y and 13 mo when weaned based on an assumed mean date of birth of June 4 (Pitcher et al., 2001b).

Overall, most Steller sea lions appeared to wean at the start of the breeding season when 1 or 2 y old. In general, most males observed in southeast Alaska during the late 1990s appeared to wean at about 2 y of age, while females were weaning at 1 and 2 y (Figure 2, Table 3). This is based on the high proportion of males (~90%) and females (~50%) still suckling towards the end of their second year, and the rarity of animals observed suckling at > 2 y. Our data further indicated that a few immature sea lions maintained a bond with their mothers for longer. In this regard, one of our male focal animals (brand no. F490) was observed suckling in all periods of observation at Timbered Island—and was still suckling on our last day of observations when he was 4 y old and larger than his mother.

Attendance Patterns and Site Fidelity

Mean trip lengths of lactating females averaged 54 h in winter (3 sites over 3 y, eastern and western populations combined, n = 68 females), 30.4 h in spring (1 site, n = 39), and 39.5 h in summer (2 sites over 2 y, n = 63) (Table 4). The parametric model and nonparametric tests detected significant differences in mean time spent away from the haulouts ($F_{7,162}$ = 3.39, p = 0.002). A Tukey test on mean time away indicated differences among all three seasons, but not for different sites for the same time of year. Thus, we concluded that time spent away by lactating sea lions was longer on average in winter than in spring and summer (Table 4, Figure 3).

Time spent away from the haulouts in the region by pups and yearlings during winter were pooled

Table 3. Proportion of marked Steller sea lions observed suckling by age, sex, and time of year, and proportion of all marked individuals that were male at Timbered Island

Age (months)	Month of observation	Males			Females			Total	%
		Mean	SE	n	Mean	SE	n	N	males
7	January	0.67	0.21	6	0.71	0.18	7	13	46
8	February	1.00	0.00	8	1.00	0.00	11	19	42
9	March	1.00	0.00	5	0.89	0.11	9	14	36
12	June	0.50	0.29	4	0.40	0.16	10	14	29
13	July	0.25	0.25	4	0.00	0.00	5	9	44
19	January	0.80	0.20	5	0.25	0.25	4	9	56
20	February	1.00	0.00	8	0.50	0.22	6	14	57
21	March	1.00	0.00	8	0.67	0.21	6	14	57
34	April	0.00	0.00	2	0.00	0.00	6	8	25
35	May	0.00	0.00	4	0.08	0.08	13	17	24
36	June	0.00	0.00	5	0.09	0.09	11	16	31
37	July	0.00	0.00	5	0.08	0.08	13	18	28
46	April	0.50	0.50	2	0.00	0.00	4	6	33
47	May	0.50	0.29	4	0.00	0.00	4	8	50
48	June	0.50	0.50	2	0.00	0.00	2	4	50
49	July	0.00	--	1	0.00	0.00	5	6	17

Table 4. The mean duration of trips made by immature and lactating Steller sea lions observed using haulouts in the western and eastern populations from winter to summer

		Western population			Eastern population				
Age class	Season	Trip (h)	SE	*n*	Trip (h)	SE	*n*	Regional comparison	
Immature	Winter	39.0	4.47	33	40.0	2.91	37	t_{68} = -0.19	$p = 0.85$
	Spring	--	--	--	35.8	3.83	38	--	--
	Summer	38.6	8.56	14	32.5	3.13	66	t_{78} = 0.78	$p = 0.44$
Lactating	Winter	59.7	5.91	32	49.0	3.47	36	t_{66} = 1.60	$p = 0.11$
	Spring	--	--	--	30.4	2.90	39	--	--
	Summer	32.1	4.26	6	46.6	4.61	57	t_{61} = -1.01	$p = 0.32$

(after finding no significant differences between the two age groups) and averaged 39.5 h (3 sites over 3 y, n = 70 immatures; Table 4). Mean trip lengths of yearlings were 36 h in spring (1 site, n = 38) and 35.5 h in summer (2 sites over 2 y, n = 80; Table 4). Sample sizes were insufficient to calculate mean trip lengths of pups in spring and summer. No significant seasonal change was noted in time spent at sea by immature sea lions when data from the two regions were pooled ($F_{2,185}$ = 1.12, p = 0.33; Table 5); however, there was a significant difference within the eastern population in the mean duration of time spent away (40 h winter, 36 h spring, and 33 h summer; $F_{2,138}$ = 5.36, p = 0.002; Table 4). Comparing age classes revealed that time spent away by immature sea lions was significantly shorter than lactating females during winter (t_{136} = -3.43, p < 0.001) and summer (t_{141} = -2.31, p = 0.02), but not during spring (t_{75}=1.11, p = 0.27) (Table 5, Figure 3). The longest average

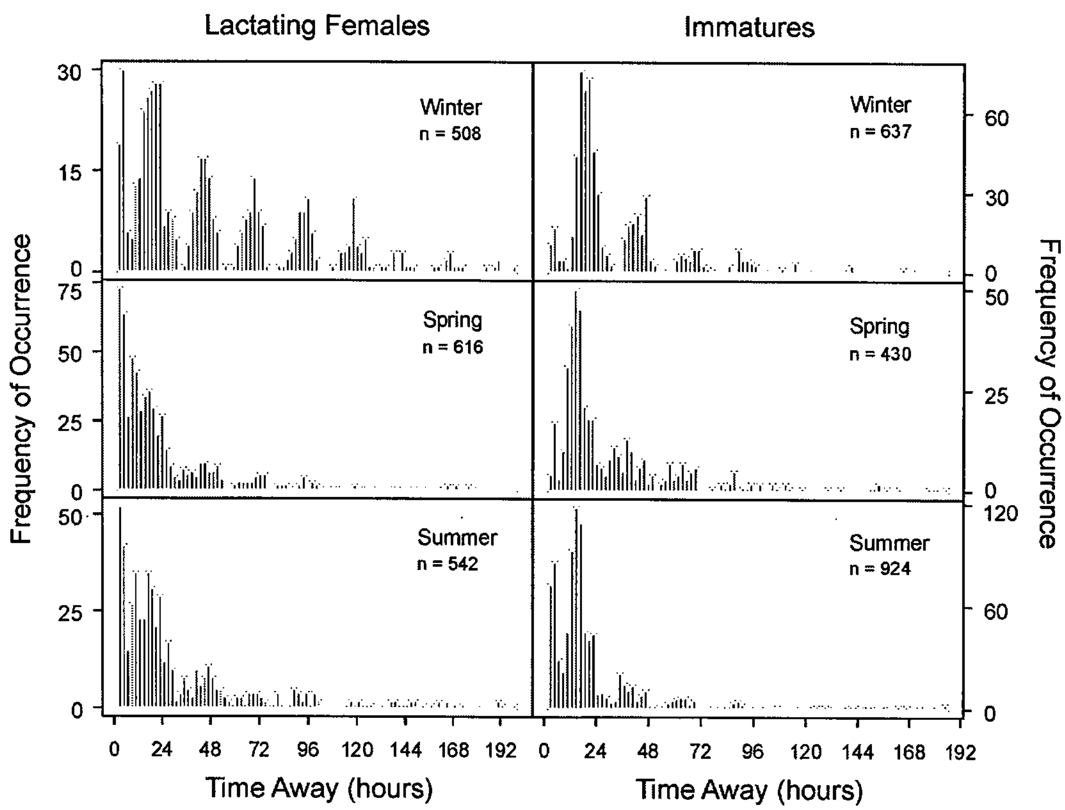

Figure 3. Time spent away from Timbered Island by all identifiable lactating and immature Steller sea lions in winter (January to March), spring (April to May), and summer (June to July); immature sea lions include pups and yearlings, and time away shows intervals > 3 h and < 200 h. Time away likely reflects individual trips, but it may also include some multiple trips if animals were missed when they returned to the haulout or if they used an alternative haulout between visits to our study sites.

Table 5. The mean duration of trips made by immature and lactating Steller sea lions observed using haulouts during winter, spring, and summer

Season	Immatures Trip (h)	SE	*n*	Mature females Trip (h)	SE	*n*	Age class comparison	
Winter	39.5	2.59	70	54.0	3.37	68	$t_{136} = -3.43$	$p < 0.001$
Spring	35.8	3.83	38	30.4	2.90	39	$t_{75} = 1.11$	$p = 0.270$
Summer	33.6	2.97	80	45.2	4.22	63	$t_{141} = -2.31$	$p = 0.022$

times away occurred during winter for both mature and immature age categories (Table 5).

Known mother-immature pairs had identical trip durations for 81 recorded trips. Such "paired" trips occurred at three sites (Sea Otter, Marmot, and Timbered Islands) over 2 y (1997 to 1998) and all three seasons. The majority of these trips (63%) were observed during spring observations at Timbered Island in 1998. One interpretation is that mothers and their young were traveling together; however, it is more likely that mothers (identified by their association with their offspring) had returned to the haulout to await their pup following a relatively short feeding trip and were not recognized until their branded offspring had appeared.

Pooling site fidelity data from pups and yearlings (after finding no significant differences between the two age groups) revealed significant differences between sites and seasons in the percent of time that immature sea lions spent on shore ($F_{7,134} = 11.35$, $p < 0.001$) and with their mothers ($F_{7,134} = 6.98$, $p < 0.001$) (Table 6). Seasonally, immature Steller sea lions spent more time on haulouts during winter than they did during summer. We did not detect any significant variations between different sites within the same season, and we found the same results for their mothers. This correlation between attendance patterns of mothers and young is not surprising given the bond and dependence that exists between mothers and their young.

Some of the immature sea lions consistently used the Timbered Island haulout (where we observed sea lions for the greatest number of years and seasons, and where we knew the ages and sexes of many immature sea lions from their brand numbers). Other sea lions used this site for weeks at a time, while some were only seen for a few days. For these infrequent visitors, Timbered Island was likely one of a number of haulout sites used by some mature females and their dependent young. Thus, it is difficult to generalize about site fidelity other than to say that some sea lions showed high site fidelity to a single site while others were likely regular users of a number of different sites.

The proportion of branded Steller sea lions at Timbered Island shifted from roughly equal numbers of males and females at age 7 mo (54% females) to a preponderance of females by age 12 mo (71%); however, the proportion switched to predominately males at ages 19 to 21 mo (57% males) before falling in April to June (to 25%; Table 3). The proportion of males remained low for the next 12 mo. The differences likely reflect sex-specific behavioral differences in the timing of weaning and dispersal of young sea lions.

Table 6. Proportion of time that immature Steller sea lions (n = 143) were seen on shore (as a function of total number of h observed) or were observed with their mothers (as a function of the total number of h their mothers were present)

Season	Time on shore %	SE	*n*	Time with mother %	SE	*n*
Winter	24.1	2.12	52	45.0	3.15	52
Spring	13.9	1.96	34	41.0	5.30	34
Summer	12.2	0.94	57	21.2	3.24	57

Discussion

Our study evolved from a series of exploratory investigations and would have been strengthened by choosing to continuously follow two sites from winter to spring. Unfortunately, we did not anticipate the difficulties of observing Steller sea lions in winter and did not realize at the time that the majority of weaning did not occur during winter. Our findings are thus pieced together from different sites, years, and seasons. While we are confident about our overall findings, they are not as clear and precise as we would have liked. Future behavioral studies would therefore be well advised to focus on following one or more haulout sites for an entire year or longer with no break in observations.

Suckling and Weaning

Weaning is ultimately a resolution of an inherent conflict between the length of time it is beneficial for a mother to continue to invest in a current offspring and the longer period that it is beneficial for an offspring to have its parent continue that investment (Trivers, 1974; Mock &

Forbes, 1992; Godfray, 1995). Initially, the cost of nursing is relatively small for the female while conferring a comparatively large benefit to the pup; however, the potential cost of continued nursing to the female increases as the pup grows in size and increases its energetic demand. There is also an incurred cost if continued nursing jeopardizes the mother's future reproductive success.

The polygynous mating system of Steller sea lions means that mothers will be more closely related to their offspring than pups will be to their siblings. This results in a discrepancy in the cost of future reproduction and optimal time of weaning from the mothers' and pups' perspectives. The point in time when weaning occurs should therefore primarily reflect the females' interest given that she ultimately has control in providing milk to her pup (Godfray, 1995). Nevertheless, some pups may wean themselves and depart prior to a mother terminating nursing (e.g., northern fur seals; Gentry, 1998). The exact timing of weaning is likely dependent on a number of variables, including maternal condition, future maternal reproductive potential, gender and age of offspring, and environmental conditions. Hence, weaning is probably a gradual process that occurs on different schedules by mother/pup pairs within the same population.

We detected a drop in the proportion of time that yearlings (observed between 1.5 to 2.0 y) spent suckling from winter to spring and summer (Table 2). This presumably reflects a gradual process of weaning during which the yearlings likely supplement their milk diet with solid food. We did not note a similar change for pups, however, due perhaps to insufficient sample sizes of this age group during spring and summer (Table 2). We found no indication that weaning started in winter (January to March). Rather, it appears to start during spring (April to May). This conclusion is consistent with the observation of Pitcher & Calkins (1981) that fewer multiparous females in the Gulf of Alaska during the 1970s were lactating between April and May (61%) than between June and March (when 82% were lactating). It is also consistent with our observation that pups and yearlings spent a greater proportion of their time in the water during spring compared to winter (Table 6).

An average of 88% of the pups we observed at Timbered Island during winter (January to March) were suckling (Figure 2B). The remaining 12% of the pups were not seen long enough to confirm whether they were weaned. We suspect that these individuals were still dependent, however, and were either simply in transit to other haulouts with their mothers when seen or had made short, independent trips to our study sites from their principal haulouts while their mothers were foraging. Extending this logic to the yearlings observed in winter suggests that our estimated proportion of dependent yearlings is also underestimated.

Our data suggest that most Steller sea lions weaned shortly before their first or second birthdays, although we did observe a single individual nursing at 3 and 4 y of age (Figure 2B). Our data further suggest that significant numbers of dependent young left the haulouts in the summer with their mothers and returned with them in the fall and winter (based on the dip and rise in proportion of branded sea lions observed suckling between spring and winter from ages 6 mo to 1.5 y; Figure 2B). Observations during the breeding season have noted that significant numbers of pregnant sea lions arrive on rookeries with suckling subadults (ages 1+ y) in late May and early June (Gentry, 1970; Perlov, 1970; Sandegren, 1970). Following birth, a mother may show increased antagonism towards her dependent subadult until it has weaned, or she may reject her newborn pup and renew her bond with the persistent subadult.

Observations from Timbered Island showed that yearling males (observed at ages 1.5 to 2 y) returned with their mothers to the haulout in significantly greater numbers than females (Figure 2). This may reflect yearling males being more persistent at driving off a newborn pup, which, in turn, might be related to the higher energetic needs of young males compared to females (Winship et al., 2001, 2002). The higher proportion of females observed at 2.5 to 3 y is consistent with young males tending to travel further from their haulouts and rookeries of birth (Raum-Suryan et al., 2004).

Our observations indicated that the proportion of time immature Steller sea lions suckled declined through the spring to early summer, suggesting that most sea lions weaned before the start of the following breeding season when 1 or 2 y old. Our conclusion that sea lions wean shortly before their first or second birthdays is consistent with that drawn by Raum-Suryan et al. (2004) and Rehberg (2005) using telemetry data. Rehberg (2005) found that the diving patterns of pups changed near the end of their first year (11 to 12 mo) to resemble those of adults. Pitcher et al. (2005) also noted changes in mean-dive-duration and maximum-daily-depth around first and second birthdays, while Raum-Suryan et al. (2004) noted that the annual timing of weaning appeared to be less variable than the age of the offspring at weaning.

The declining proportion of time spent suckling suggests that sea lions began supplementing their milk diet with solid food beginning in the spring when the reduced lengths of trips by lactating females (Figure 3) suggest that prey were more easily obtained. In retrospect, it is perhaps not too surprising that Steller sea lions should begin to wean during spring and complete weaning by early summer. Each pup represents a major investment to the female both in terms of absolute energy input (Winship et al., 2002) and in terms of lifetime reproductive success (given they produce a maximum of one pup per year). It would therefore not make evolutionary sense for a mother to wean her pup at a time of the year that is not optimal for its survival. Weaning shortly before the start of the next breeding season also allows a female to return to a rookery to give birth and mate.

One interpretation of our data from southeast Alaska is that about 50% of females observed in the 1990s weaned at 1 y, and the remainder weaned at 2 y (Figure 2, Table 3). In contrast, it appears that most males weaned at 2 y. While it might be argued that weaned male pups would have left our study area and would therefore not have been observed as yearlings, the disproportionally high numbers of male yearlings compared to females using our study haulouts suggests otherwise (Table 3). Our conclusions are based on observations made in southeast Alaska during the late 1990s while the Forrester Island breeding population (the largest rookery and closest to Timbered Island) had stabilized and the overall growth of the southeast Alaska population had slowed (Calkins et al., 1999; Sease & Loughlin, 1999).

The apparent plasticity in timing of weaning (ranging from 1 to 3 y) suggests that populations incurring nutritional stress may nurse their pups for a second year to enhance the pups' chances of survival. Females appear to wean sooner than males. The higher proportion of males we observed suckling at 1.5 y may be indicative of a population approaching carrying capacity. Thus, it is possible that mean age of weaning in populations that are at or near carrying capacity is 2 y—as opposed to 1 y in an increasing population—and that the sex ratio of suckling young in a food stressed population may be equal for 2 y olds and biased towards males at 3 y. Such a shift in weaning dates would effectively cut the birth rates of Steller sea lion populations by more than half, thereby stabilizing population growth or contributing to population decline. Such a mechanism is mathematically equivalent to maintaining birth rates and reducing juvenile survival and may account for a large part of the decline of sea lions in western Alaska.

Attendance Patterns and Site Fidelity

The sex ratio of branded Steller sea lions at Timbered Island showed that pups were present in roughly equal numbers during winter and spring, but that females predominated in the summer (Figure 2A). This suggests that a greater proportion of males did not wean in their first year and, therefore, followed their mothers to the rookeries. The dependence of many of the older males at ages 1.5 to 1.8 y is shown by their higher numbers at the haulout (Figure 2B). By age 3 y (when most sea lions were weaned), we observed primarily females (of the branded cohort). The absence of 3-y-old branded males suggests either a high mortality of males following weaning or, more likely, that males had a higher tendency to disperse further from haulouts near natal sites than did the females. The dispersal theory is supported by reports of larger numbers of young branded males appearing at sites further away from Forrester Island (where they were born) compared to females (Raum-Suryan et al., 2002).

Our eight sets of field studies (spanning 4 y, 3 seasons, and 4 different haulout sites) showed significant differences in sea lion attendance behavior among seasons (winter, spring, and summer), but not among haulout sites in the declining Gulf of Alaska region and the increasing southeast Alaska region. This suggests that the lactating sea lions we observed using the haulout sites in the declining area were not having any more difficulty procuring prey than sea lions at haulout sites in the growing population. We cannot comment on what type of prey they were obtaining, however, and can only draw conclusions about the time that they were away and the time that they spent on shore with their offspring.

Diets of the endangered Steller sea lions in the Gulf of Alaska have been dominated by walleye pollock (Merrick et al., 1997; Sinclair & Zeppelin, 2002), while animals in the growing southeast Alaska population consumed a more diverse diet that includes pollock, salmon, herring, sand lance, and rockfish (Trites et al., unpubl. data). Our behavioral observations suggest that prey may be equally available to sea lions in both areas; however, the energy content and nutritional quality of the diets consumed in each region are quite different (Trites & Donnelly, 2003; Winship & Trites, 2003). Recent feeding experiments with captive Steller sea lions suggest that young sea lions may not have the stomach capacity to physically process enough low-energy fish to meet their daily energy requirements. Even with a diet of high-energy fish, young sea lions appear to have very little excess stomach capacity to process more fish (Rosen & Trites, 2004). Older sea lions do not appear to be similarly constrained. This apparent physiological limit combined with relatively high energetic needs may explain why Steller sea lions wean at such a relatively old age compared to other species of pinnipeds.

Porter & Trites (2004) observed pups in the water during winter with fish in their mouths but did not see any of the pups swallow the fish they held. They also noted two cases of suckling by nonfilial pups (an extremely rare event among

Steller sea lions). The persistence of the pups' attempts to steal milk was surprising in light of the risks of being bitten by lactating females and the apparent ability of pups to capture fish. These observations add further credence to the view that pups are physiologically unable to subsist independently on a mixed diet of solid foods and require high lipid milk to meet their daily energy needs.

Our data indicated that lactating sea lions were away for longer periods in winter than in spring and summer (Figure 3). They also indicated that mothers and their young spent more time on shore during winter than in the summer. These findings are generally consistent with a model of greater maternal investment in winter. The behavioral data also suggested that pups spent a higher proportion of their time on shore and were not with their mothers during foraging bouts (Trites & Porter, 2002).

Conclusions

Our study reports the first behavioral observations of Steller sea lions using haulouts through the winter, spring, and summer months and fills an important gap in understanding their life history. Counter to our expectations, we did not observe any significant differences between the declining and increasing populations in time spent by lactating females at sea or on shore. Rather, lactating females showed seasonal changes that were consistent among all areas and years studied. This, in turn, is consistent with the view that lactating Steller sea lions make a greater maternal investment during the winter than during the spring or summer. Equally important is the discovery that weaning does not occur during winter as some have speculated, but, rather, it occurs just prior to the start of the next breeding season when conditions are likely optimal for the survival of the newly weaned offspring.

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Attachment C

DRAFT REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
December 5-7, 2005

The Scientific and Statistical Committee met during December 5-7, 2005 at the Hilton Hotel in Anchorage, AK. Members present were:

Gordon Kruse, Chair *University of Alaska Fairbanks*	Pat Livingston, Vice Chair *NOAA Fisheries—AFSC*	Keith Criddle *Utah State University*
Steven Hare *International Pacific Halibut Commission*	Mark Herrmann *University of Alaska Fairbanks*	Sue Hills *University of Alaska Fairbanks*
Anne Hollowed *NOAA Fisheries—AFSC*	George Hunt *University of Washington*	Franz Mueter *University of Washington*
Ken Pitcher *Alaska Department of Fish and Game*	Terry Quinn II *University of Alaska Fairbanks*	David Sampson *Oregon State University*
Farron Wallace *Washington Dept of Fish and Wildlife*	Doug Woodby *Alaska Department of Fish and Game*	

Members absent:

Seth Macinko
University of Rhode Island

B-1 Plan Team Nominations

The SSC reviewed the nomination of Dr. Ginny Eckert to the Crab Plan Team. **The SSC finds her well-qualified for this position and recommends approval of this nomination by the Council.**

B-2 Chiniak Gully Experiment

The SSC received an informational report from Libby Logerwell (AFSC) on a regulatory proposal to close all trawl fishing in Chiniak Gully (near Kodiak) from 1 August through 20 September 2006-2010. This closure is needed to provide a control area to evaluate a localized depletion hypothesis for the pollock trawl fishery. This project is part of a larger fishery/Steller sea lion interaction study. Two years have already been completed. Results from the first year (2001) suggested that the fishery had no effect on biomass, mean depth, or mean distance above bottom. The second year (2004) suggested a fishery-related decline in biomass. Additional years of study are needed to resolve this issue and to evaluate annual variability. The agency is now preparing an Environmental Assessment for the proposed regulatory change for final action in June 2006.

The SSC recognizes the importance of evaluating localized depletion and potential effects on Steller sea lions but has some concerns about the confounding effects of natural variation in pollock abundance and distribution making it difficult to actually evaluate fishery effects. A suggestion was made that it might be beneficial to switch experimental and control areas. Some concern was expressed that it might take a number of years to come to a firm conclusion about localized depletion and that adding only one additional year of study is unlikely to provide definitive results.

D-1(d) Review Discussion Paper on BSAI Pollock A-Season Start Date

Bill Wilson (Council Staff) provided a discussion paper on issues associated with changing the Eastern Bering Sea Pollock fishery "A" season. Public testimony was provided by Paul McGregor (At-Sea Processors Association) and Brett Payne (United Catcher Boats).

The SSC heard a presentation on moving the start of the EBS pollock fishery to three to seven days prior to the current January 20th start date to enable the EBS pollock fleet to harvest higher-quality roe. While this proposal was initiated at industry request, and was represented as an important issue for maintaining industry profitability, public testimony indicated that the proposal would be withdrawn because NMFS indicated that the proposal would likely trigger a formal Section 7 consultation under the ESA. Nevertheless, the SSC decided to comment on the proposal, suggesting areas that could be improved or expanded upon if further Council analysis were undertaken.

Steller sea lion conservation has been raised as an issue with the proposal for an earlier opening of the eastern Bering Sea pollock A season. The concern is that an earlier opening would be detrimental to sea lions. Based on knowledge of the timing of weaning and the reproductive energetics of adult females, the SSC feels that this is likely not a concern. Weaning normally occurs during late winter and spring. The energetic demands of adult females progressively increases throughout winter and spring as dependent offspring require increasing amounts of energy in the form of milk. Pregnant females require increasing amounts of energy (prey) with increasing fetus size throughout gestation. **While a 5-day advance in the start of the A season is likely to be relatively insignificant to SSLs, the effect if any would likely be positive.**

The SSC believes that the discussion of the original impetus for the January 20th start date (changed from January 1) needs to be expanded to further clarify that one of the reasons for the later start-date was to address a feature of the then open-access fishery where the race-for-fish was leading industry to catch pollock before the roe was fully ripe. **With implementation of the AFA and the end of the race-for-fish, there is no longer a need for the pollock industry to have a late starting date to protect themselves from harvesting the roe too early.**

Variation in the timing of peak roe condition, industry interest in additional flexibility for adjusting the timing of the pollock A-season, and the possibility that small changes in the A-season start date could trigger potentially extensive section 7 consultations highlight the need for care in the motivation and structuring of RPAs and other regulations. The GOA and BSAI are dynamic ecosystems that have undergone substantial regime shifts historically, with the current period being characterized by warmer surface and bottom temperatures. In addition to changes in the timing of reproduction, changes in the environment can be expected to lead to changes in the abundance, rate of increase, and geographic distribution of stocks. Because environmental variability can be expected to result in changes in the preferred timing of roe fisheries, it would be desirable to include alternatives that allow some ability to respond to such environmental changes.

The discussion of roe values and markets could be expanded into a more detailed economic analysis of the earlier season given various assumptions about improved roe quality. At the very least, a definitive statement can be made that, to the pollock fishing industry, there are great benefits associated with harvesting higher quality roe. With minimal changes in fishing costs, the ability to harvest higher quality roe has the possibility of bringing the pollock industry significant benefits. Indeed, examining pollock roe alone, the inability to harvest roe at its highest quality is a waste of the resource. **Of course, the economic gain to the commercial pollock fishery is only one aspect of a full benefit/cost analysis; a comprehensive analysis of benefits and costs would also need to consider potential spillover effects on other fisheries and the costs and feasibility of changes in monitoring and enforcement.**

D-1(e) BS Habitat/EFH

The SSC received a report from Cathy Coon (Council staff) and Craig Rose (AFSC) on Bering Sea habitat conservation. The item covered two issues. First, the SSC reviewed recent research on gear modifications in the Bering Sea to mitigate effects of bottom trawl fisheries. **This report provided**